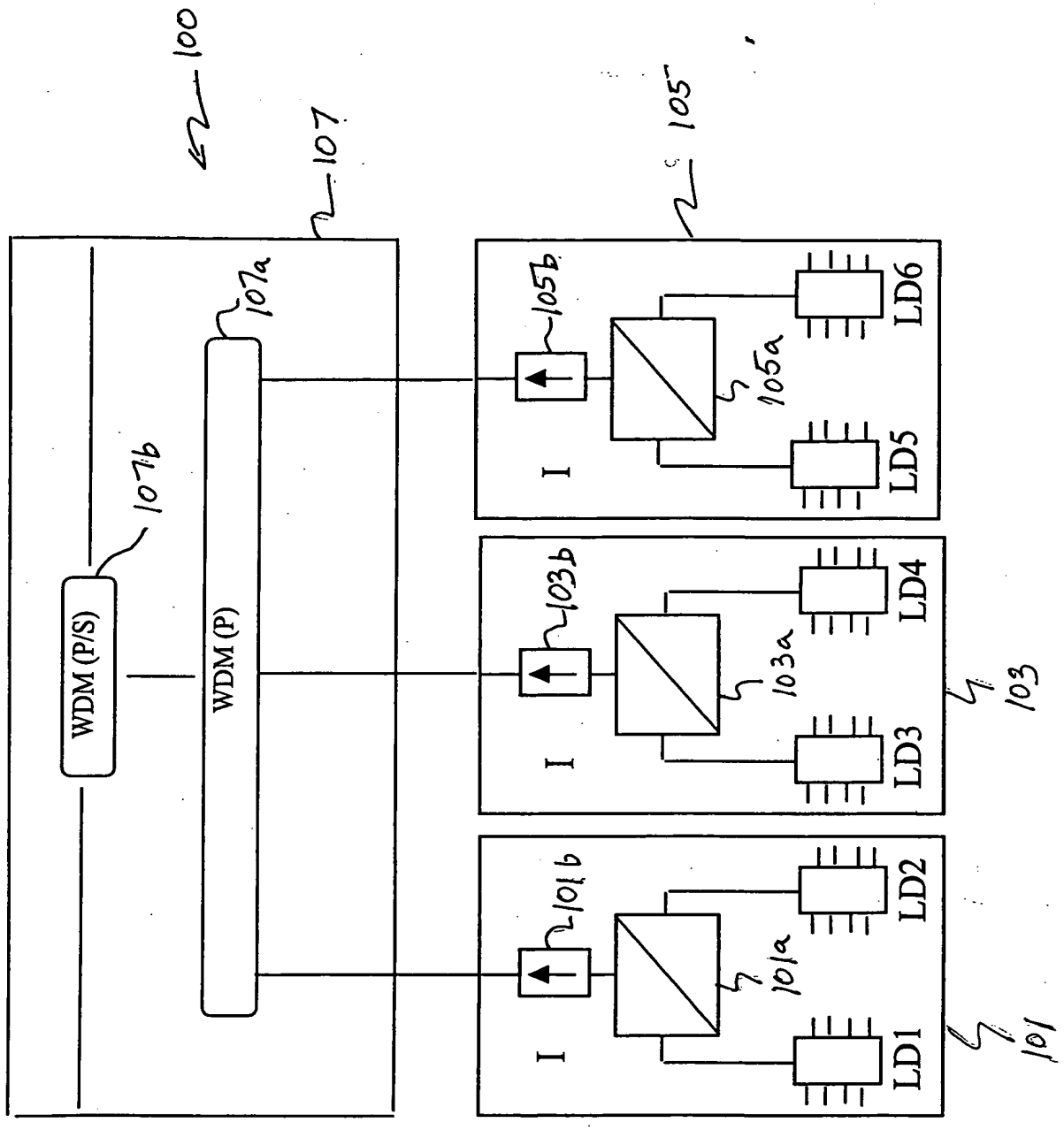
100
107
105
107a
107b
105b
105a
LD6
LD5
WDM (P/S)
WDM (P)
I
103b
103a
LD4
LD3
103
101b
101a
LD2
LD1
101

FIG. 1

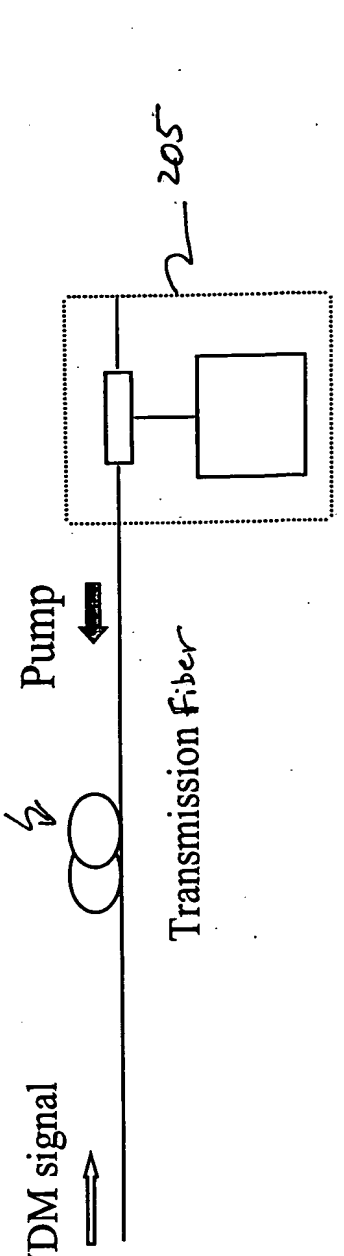

FIG. 2B

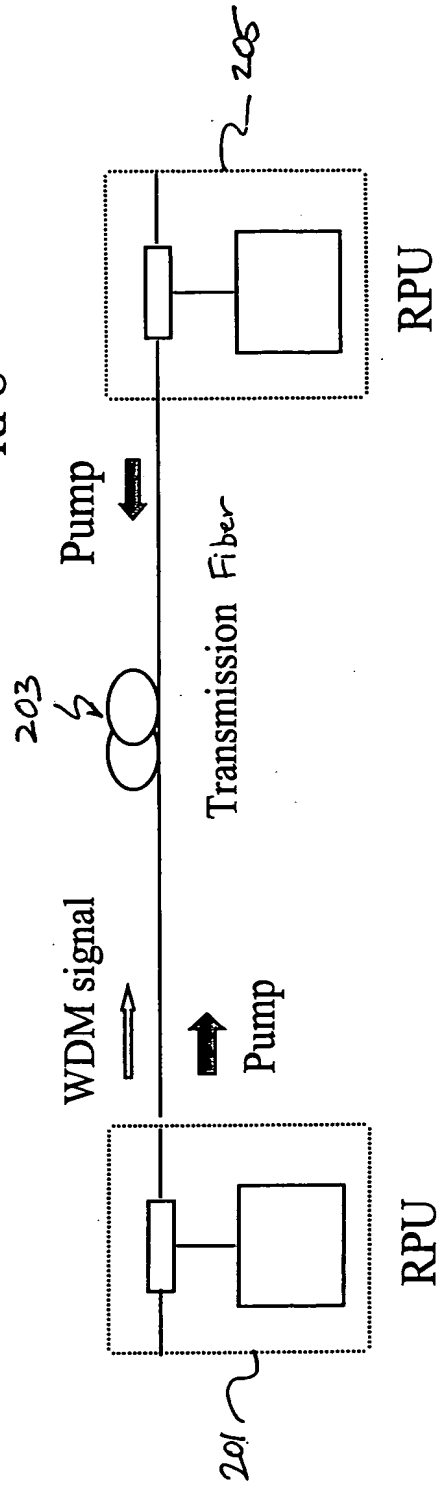

FIG. 2C

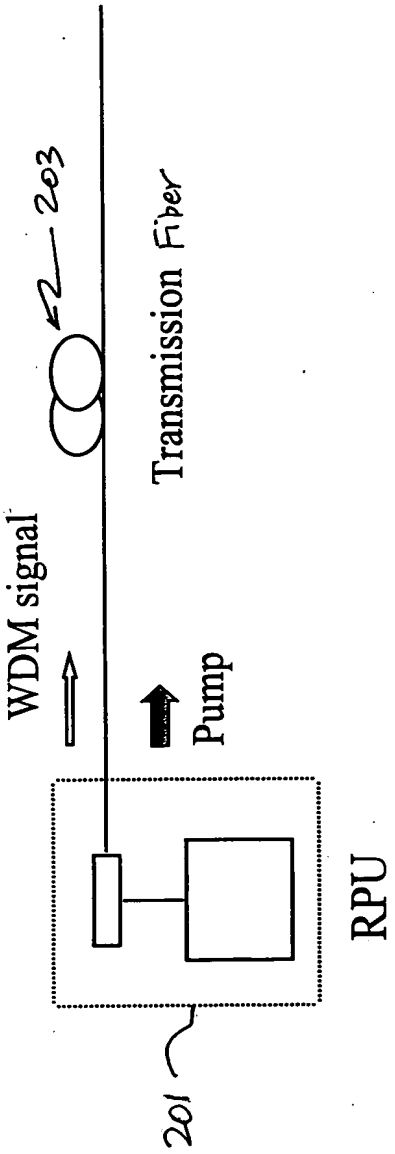

FIG. 2A

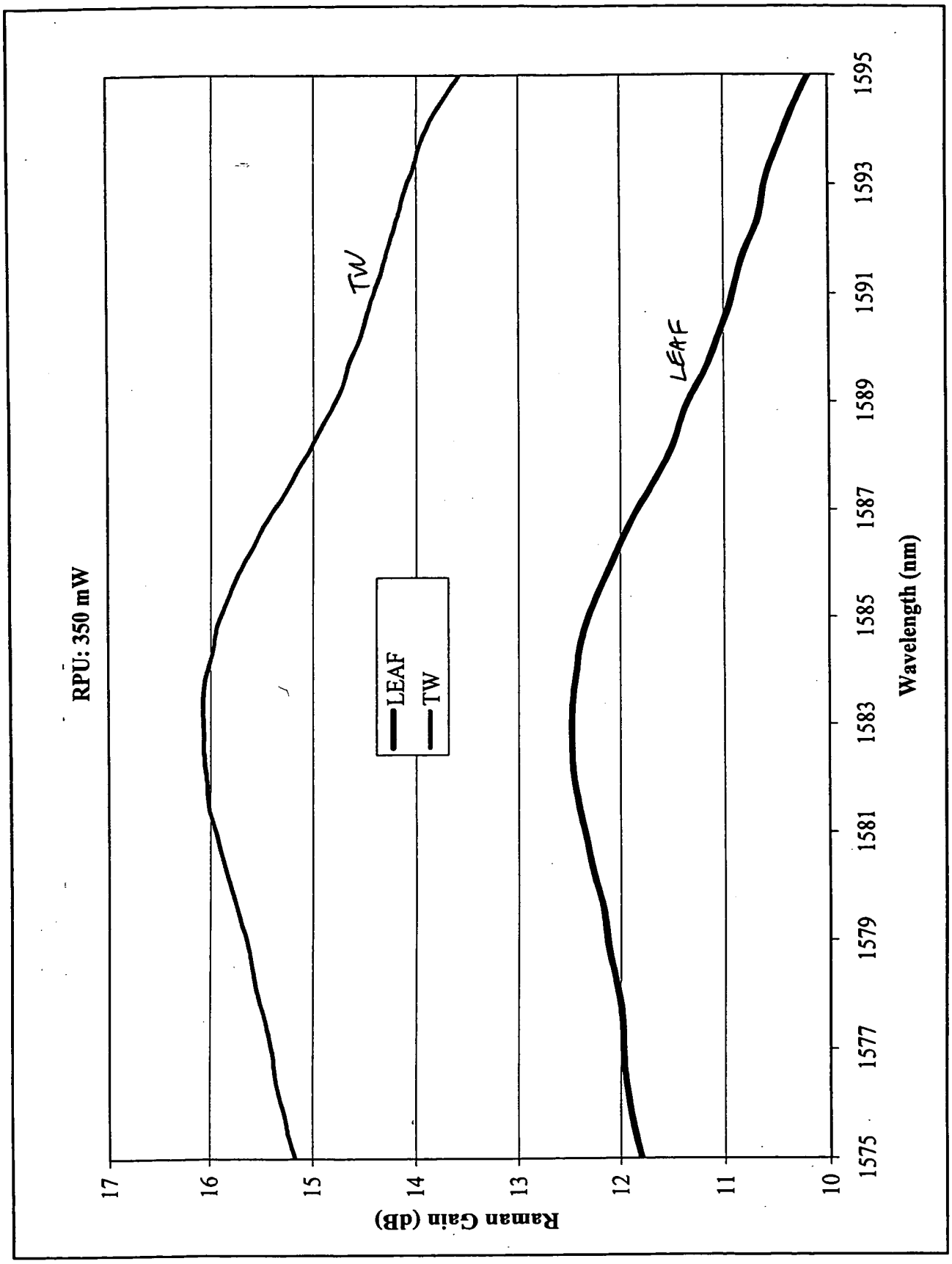

FIG. 3

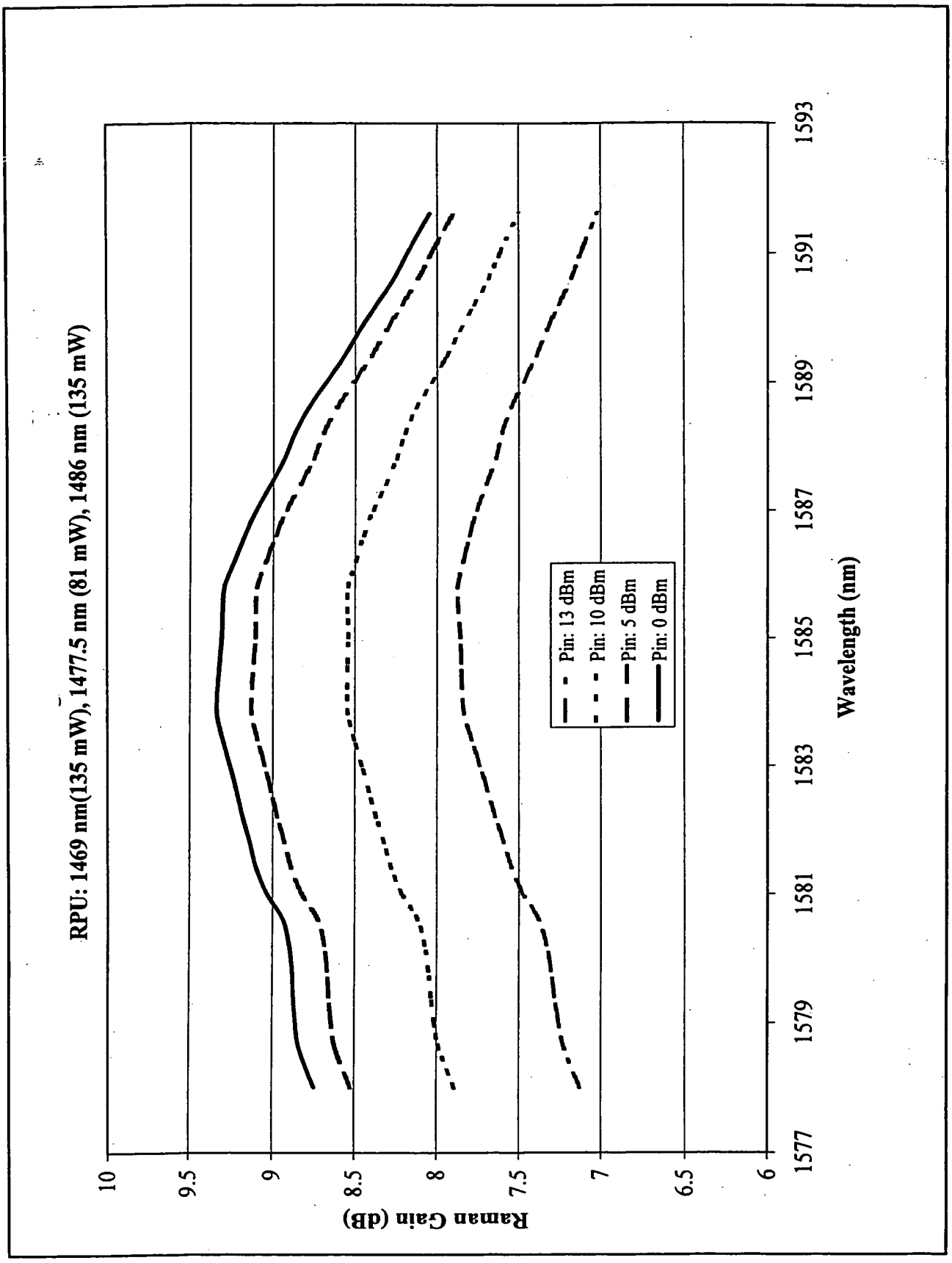
RPU: 1469 nm(135 mW), 1477.5 nm (81 mW), 1486 nm (135 mW)
Raman Gain (dB)
10
9.5
9
8.5
8
7.5
7
6.5
6
1577
1579
1581
1583
1585
1587
1589
1591
1593
Wavelength (nm)
Pin: 13 dBm
Pin: 10 dBm
Pin: 5 dBm
Pin: 0 dBm

FIG. 4

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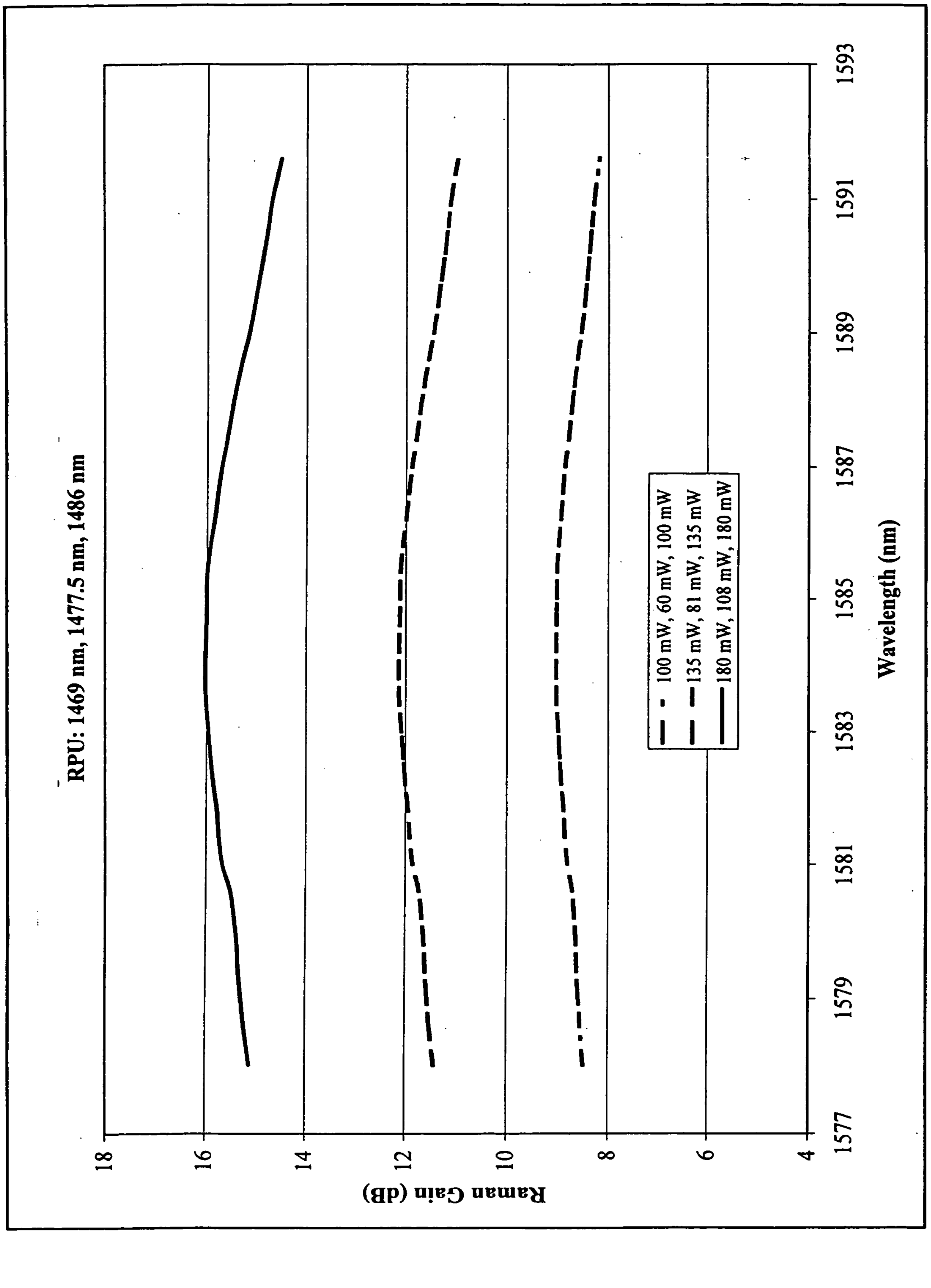

FIG. 5

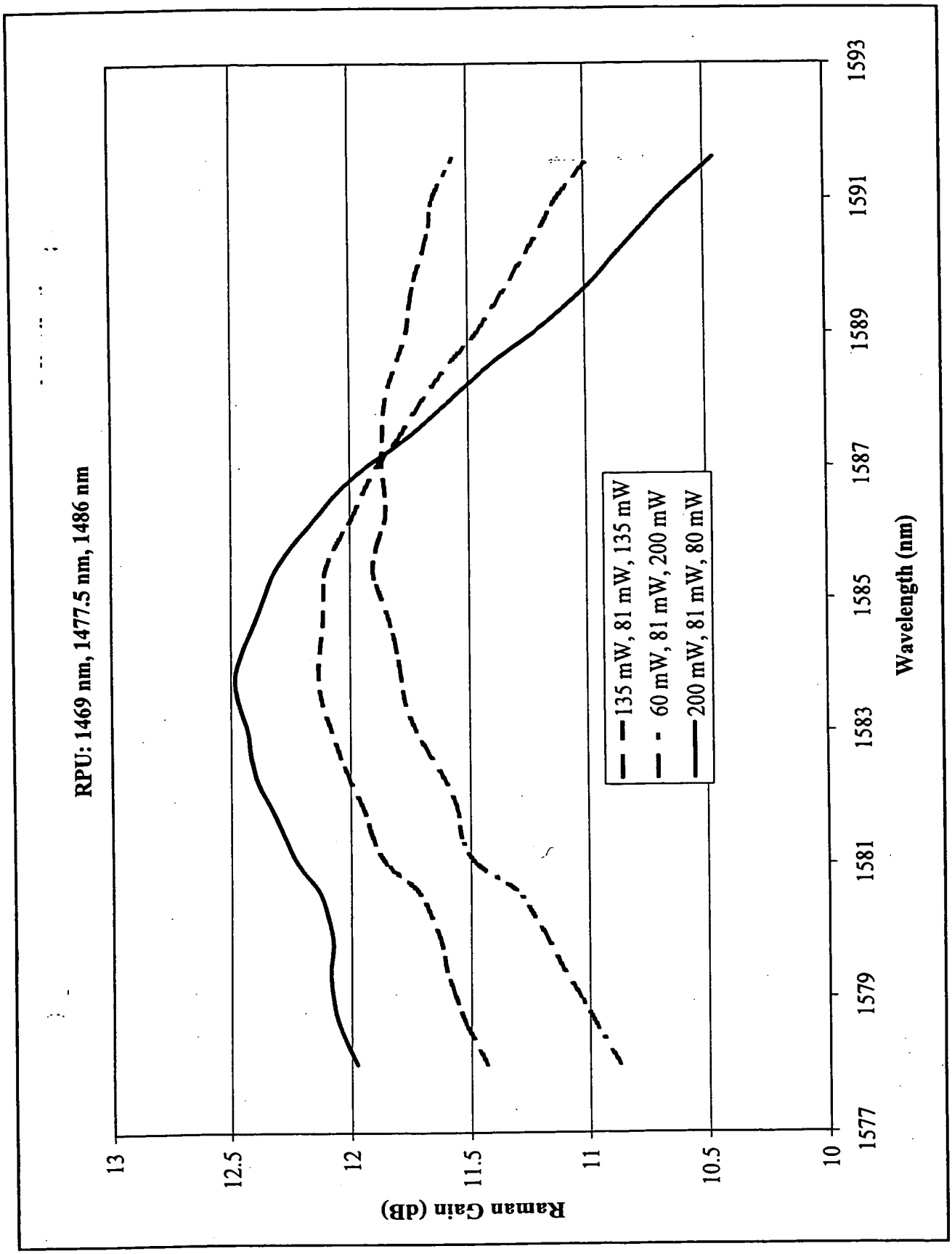
RPU: 1469 nm, 1477.5 nm, 1486 nm
Raman Gain (dB)
13
12.5
12
11.5
11
10.5
10
1577
1579
1581
1583
1585
1587
1589
1591
1593
Wavelength (nm)
135 mW, 81 mW, 135 mW
60 mW, 81 mW, 200 mW
200 mW, 81 mW, 80 mW

FIG. 6

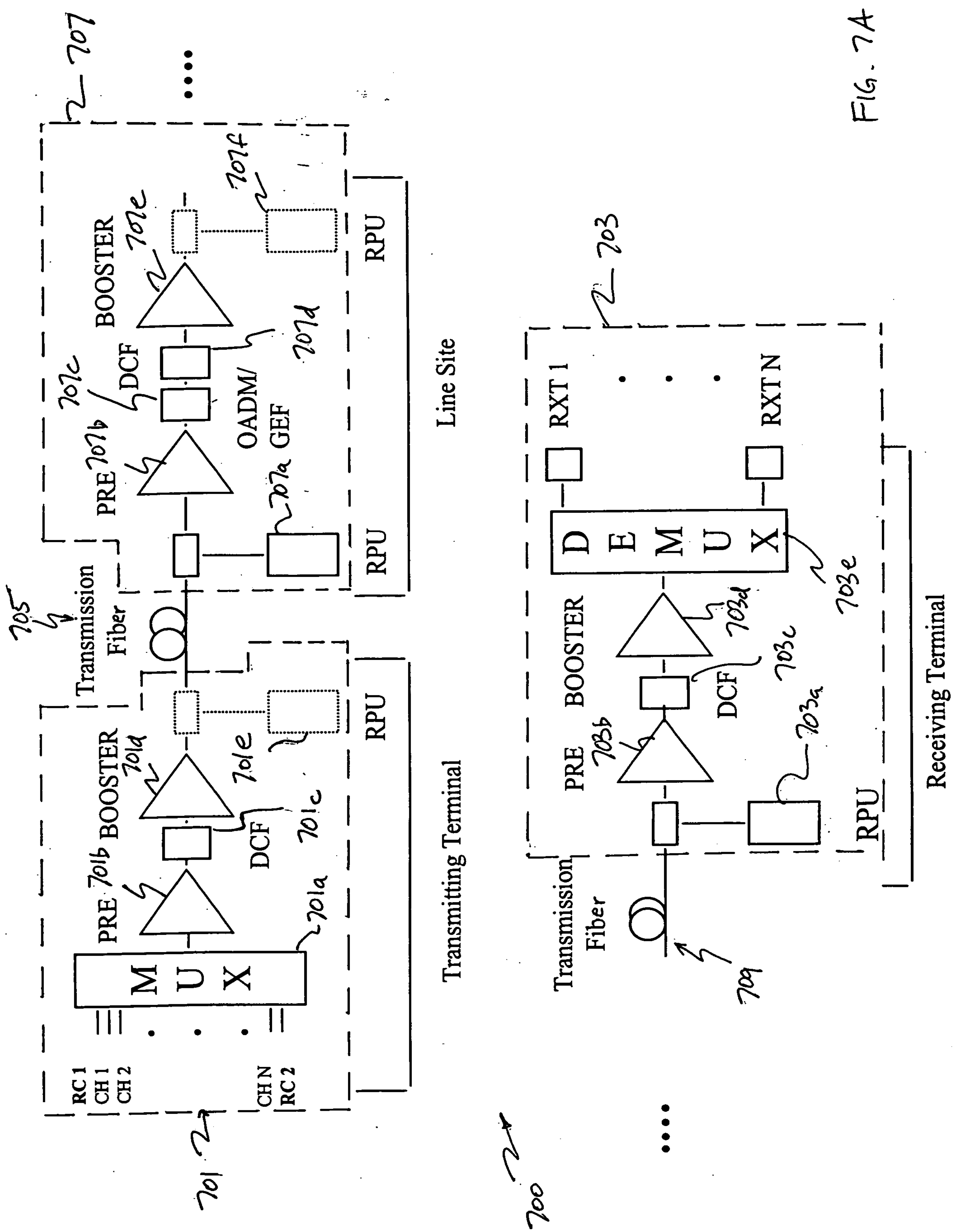
M U X
PRE
BOOSTER
DCF
RPU
Transmission Fiber
OADM/ GEF
Line Site
Transmitting Terminal
RC 1
CH 1
CH 2
CH N
RC 2
D E M U X
RXT 1
RXT N
Receiving Terminal

FIG. 7A

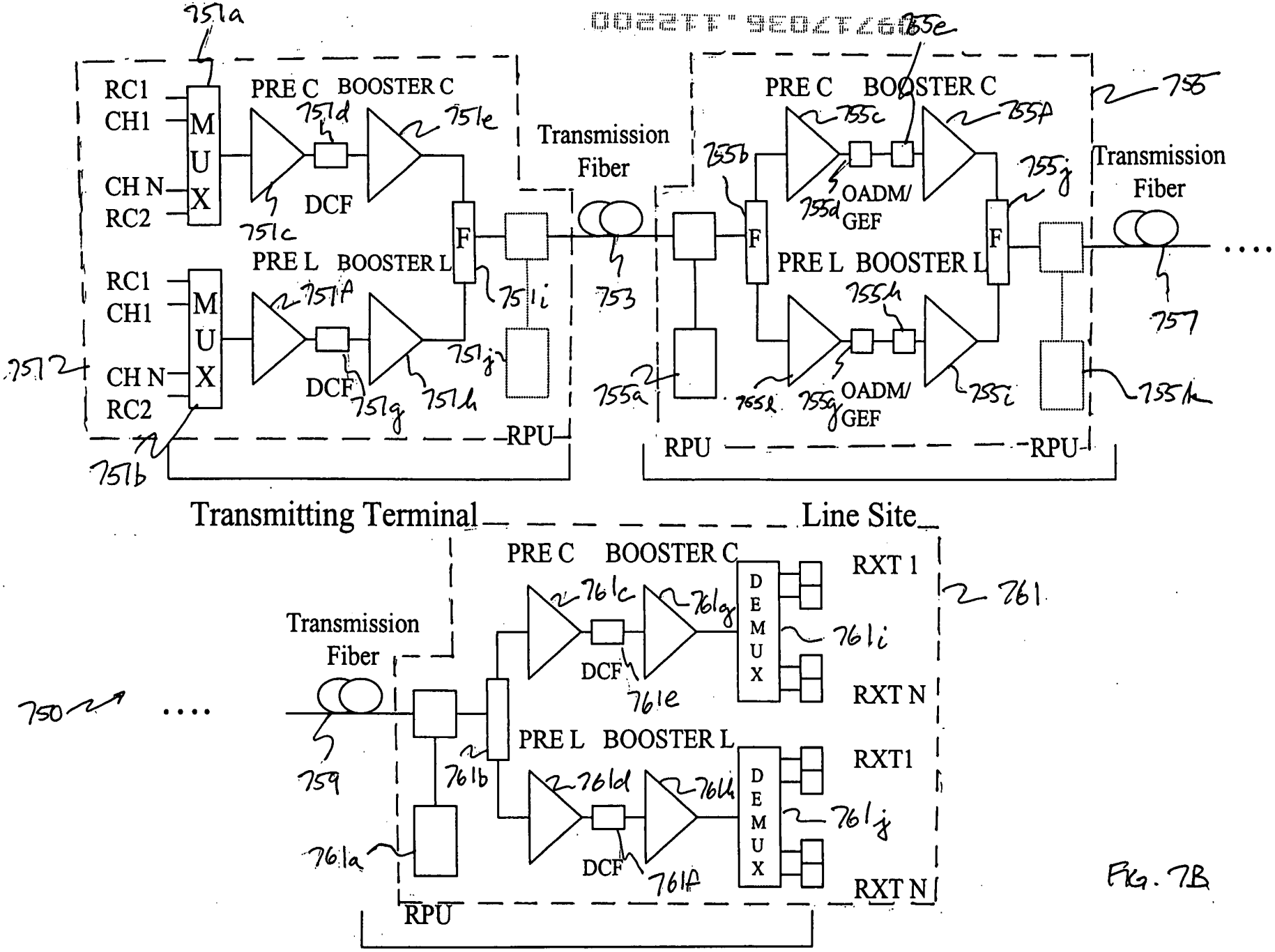

Fig. 7B

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INV: R. CASTAGNETTI, ET AL
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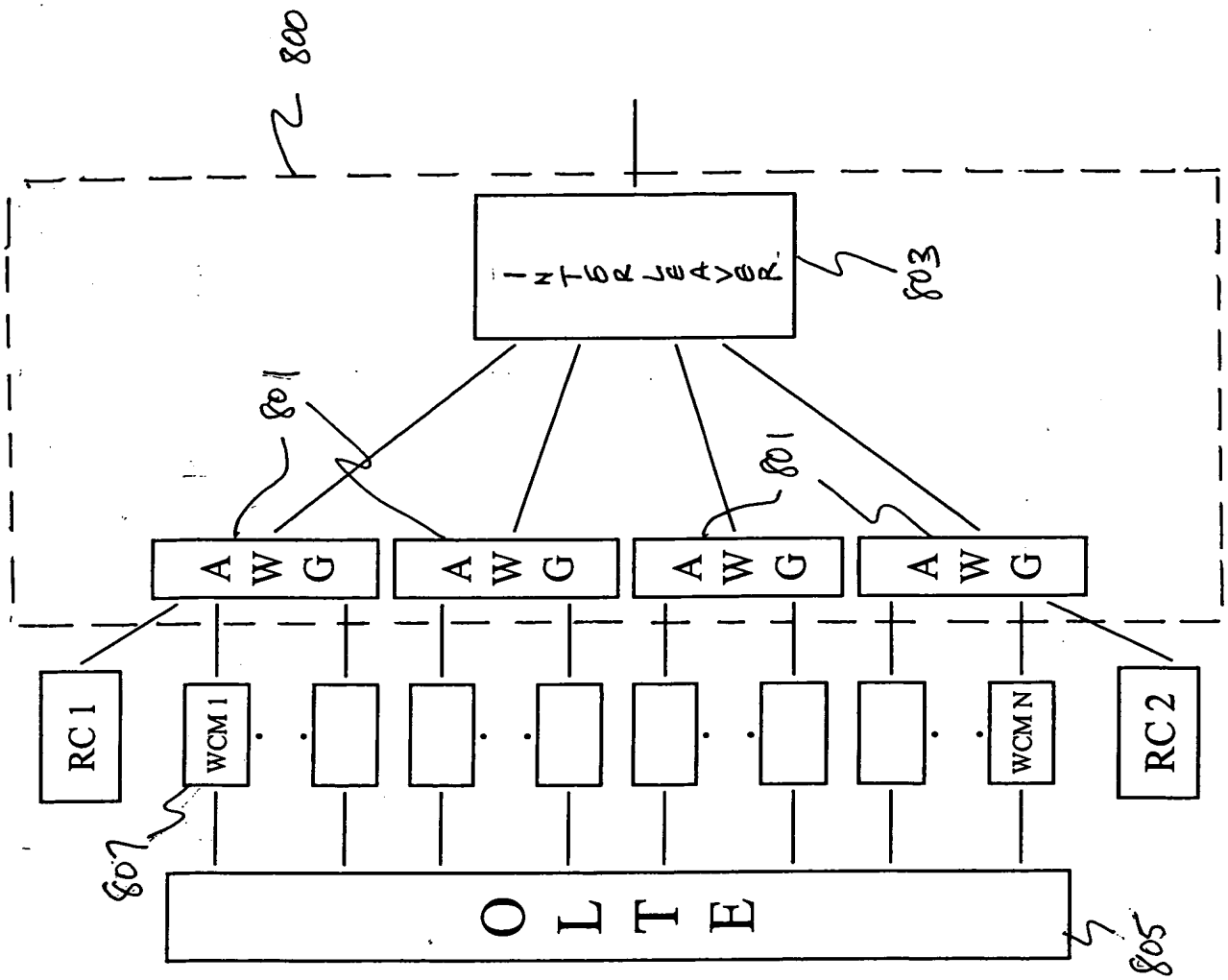
FIG. 8


800
INTERLEAVER
803
801
801
AWG
AWG
AWG
AWG
RC 1
WCM 1
WCM N
RC 2
807
OLTE
805

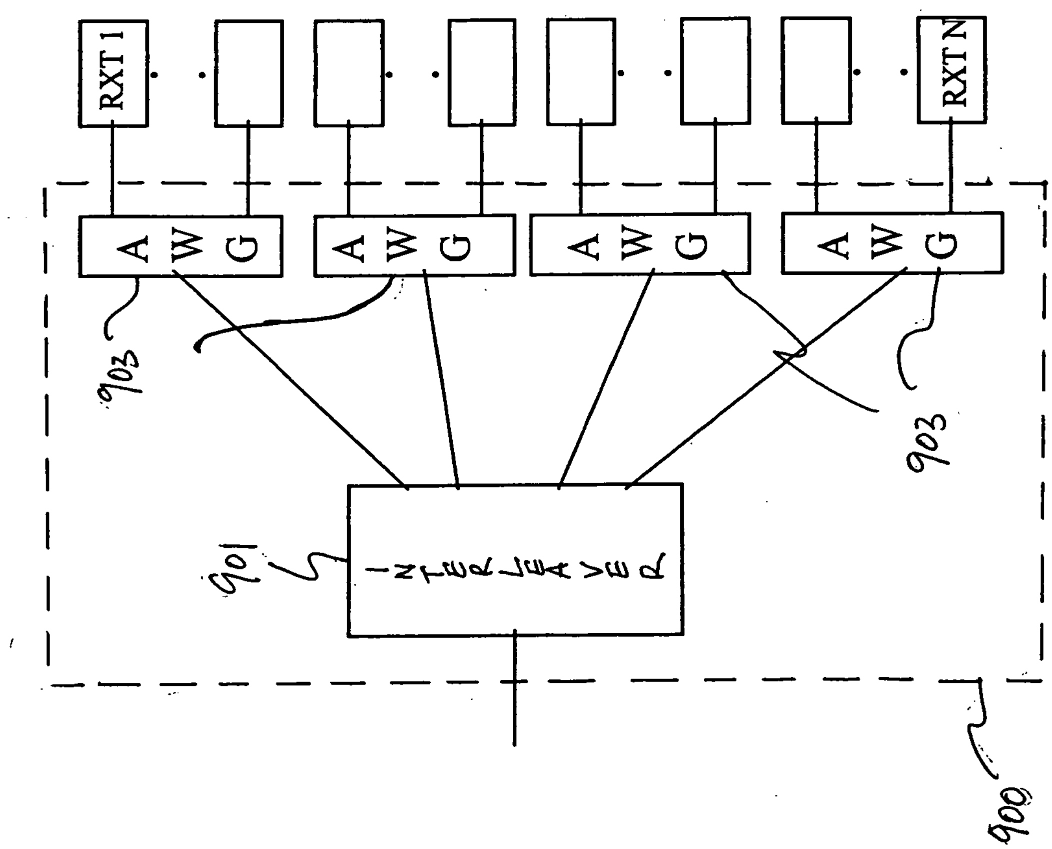


FIG. 9

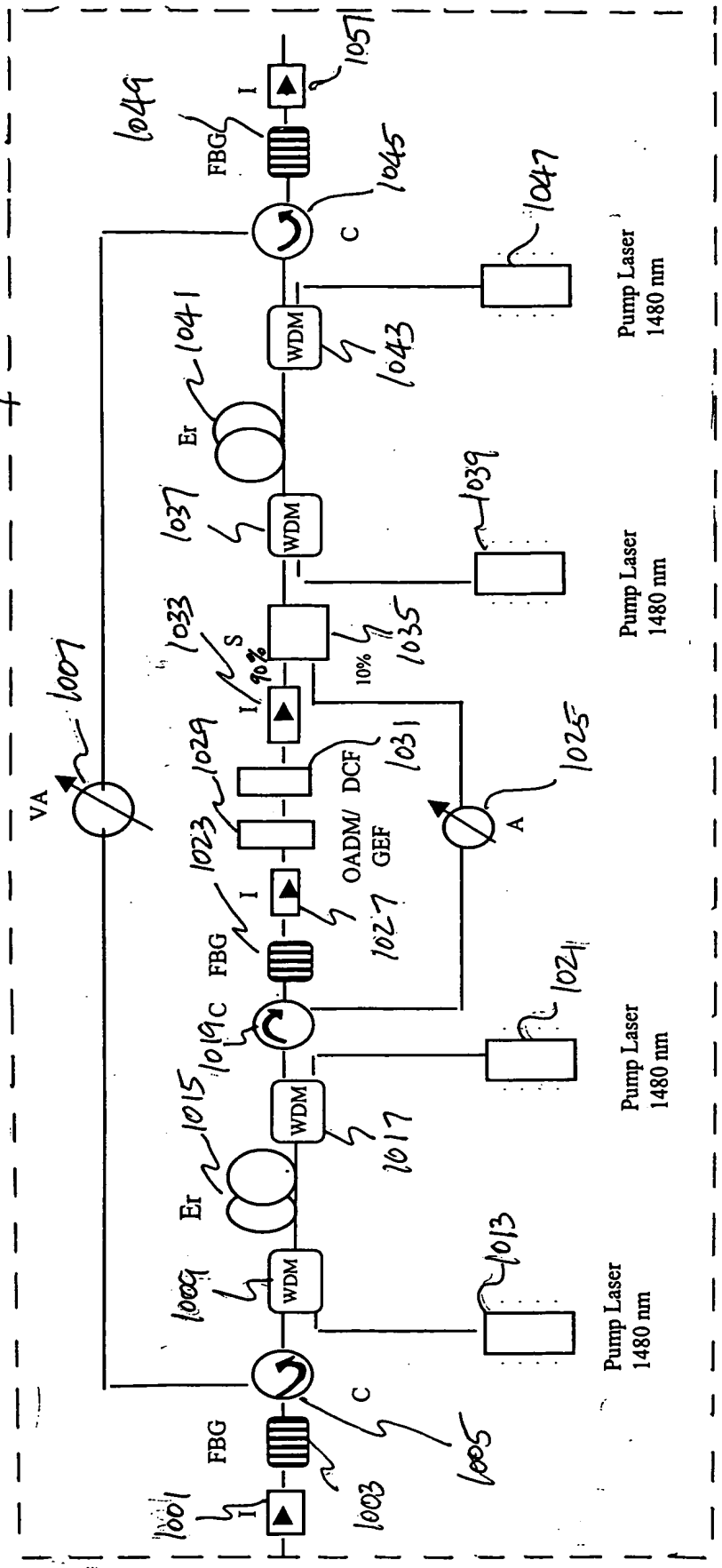

1000
1001
FBG
I
1003
C
1005
1007
VA
1009
WDM
Er
1011
1013
Pump Laser
1480 nm
1015
1017
1019
C
FBG
I
1021
1023
OADM/
GEF
1025
A
1027
1029
DCF
1031
1033
I
S
10%
90%
1035
1037
WDM
Er
1039
Pump Laser
1480 nm
1041
WDM
1043
C
1045
1047
Pump Laser
1480 nm
1049
FBG
I
1051

FIG. 10

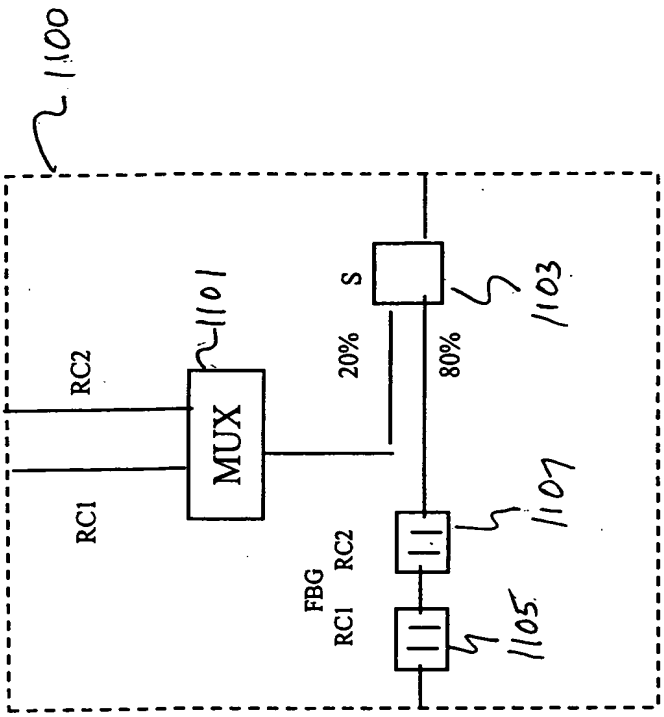


FIG. 11

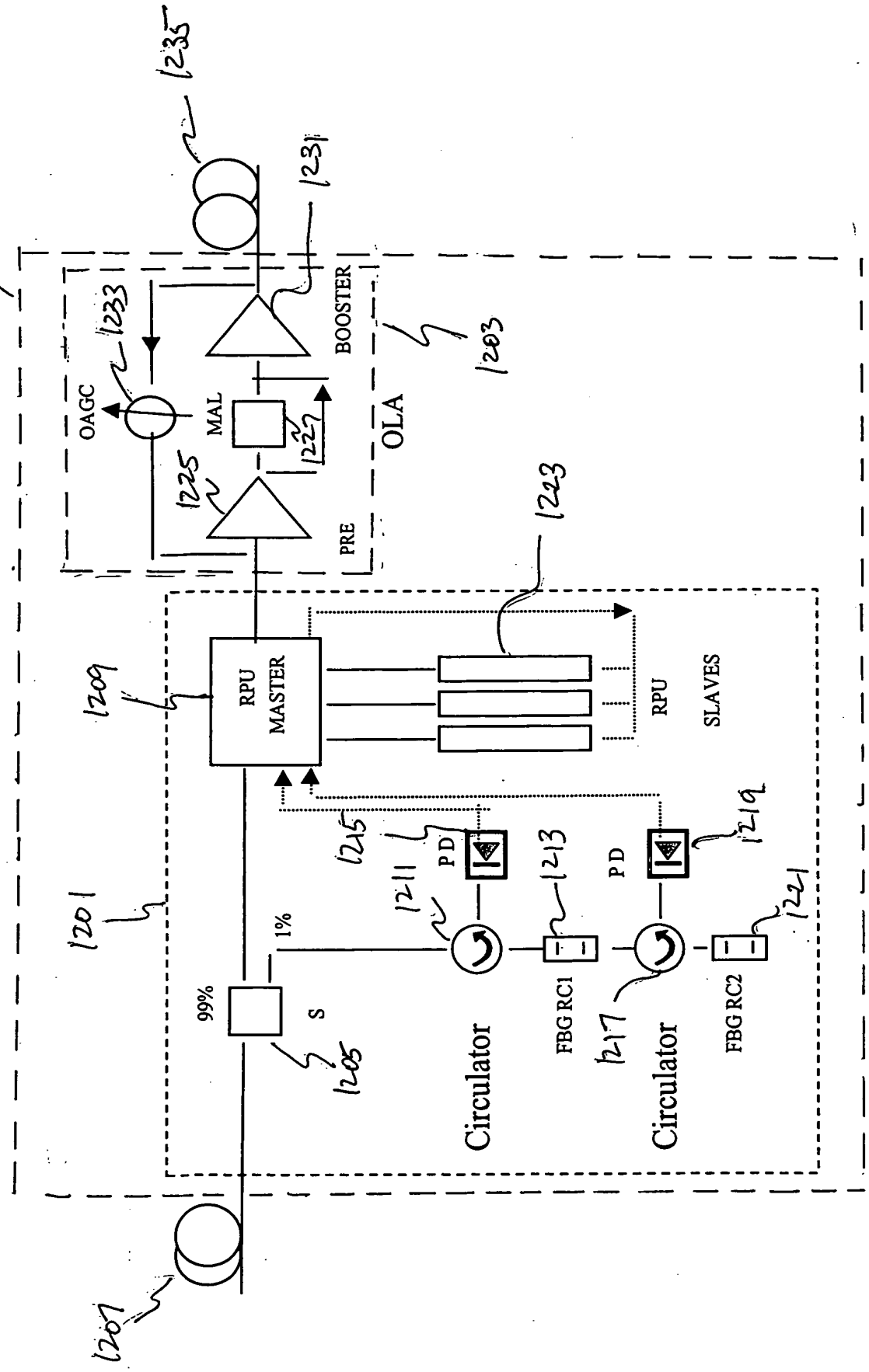

1200
1235
1231
1233
OAGC
MAL
1227
BOOSTER
1203
OLA
1225
PRE
1223
1209
RPU MASTER
RPU SLAVES
1215
PD
1211
1213
PD
1219
1201
1%
99%
S
1205
Circulator
FBG RC1
1217
Circulator
FBG RC2
1221
1207

FIG. 12

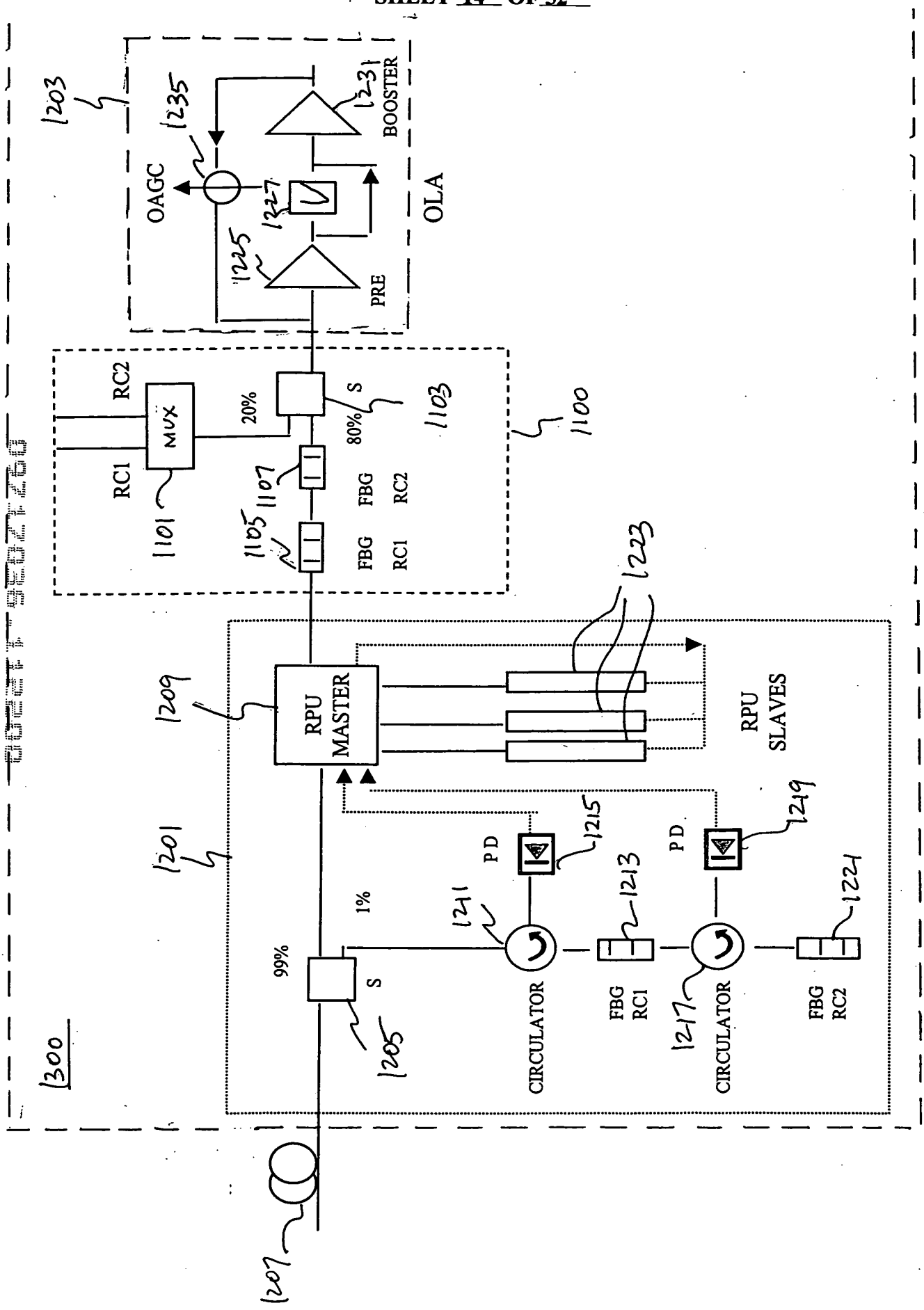

1203
1235
OAGC
1227
1225
1231
BOOSTER
PRE
OLA
RC2
RC1
MUX
1101
20%
80%
S
1103
1100
1107
1105
FBG
RC2
FBG
RC1
1223
1209
RPU
MASTER
RPU
SLAVES
1201
PD
1215
PD
1249
1%
99%
1241
1213
1224
S
1205
CIRCULATOR
FBG
RC1
1217
CIRCULATOR
FBG
RC2
1300
1207

FIG. 13

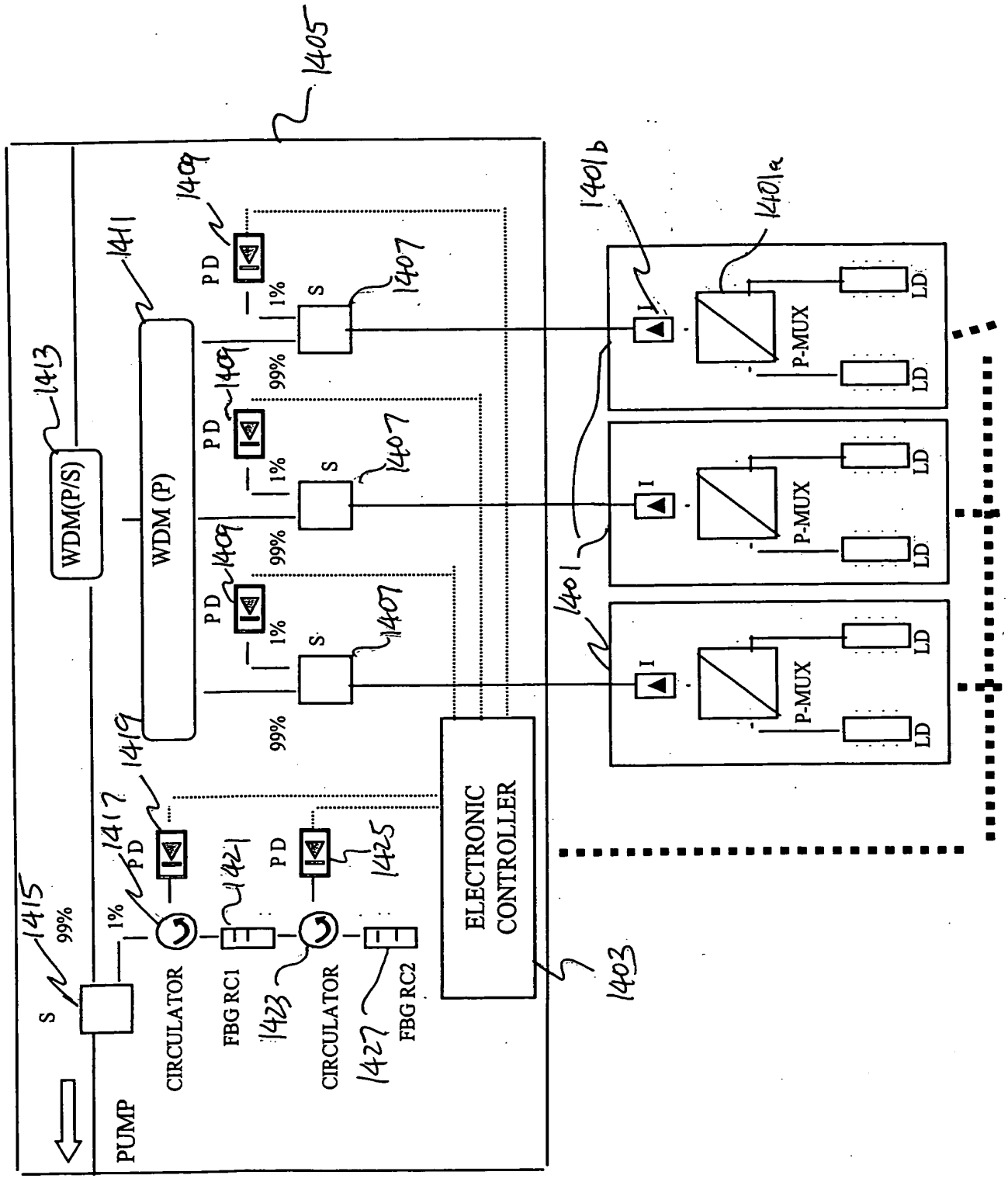

1405
WDM(P/S)
1413
WDM (P)
1411
1409
PD
1%
99%
S
1407
1401b
1401a
1401
P-MUX
LD
I
1419
1417
1415
1421
1425
1423
1427
CIRCULATOR
FBG RC1
FBG RC2
PUMP
ELECTRONIC CONTROLLER
1403
1400

FIG. 14

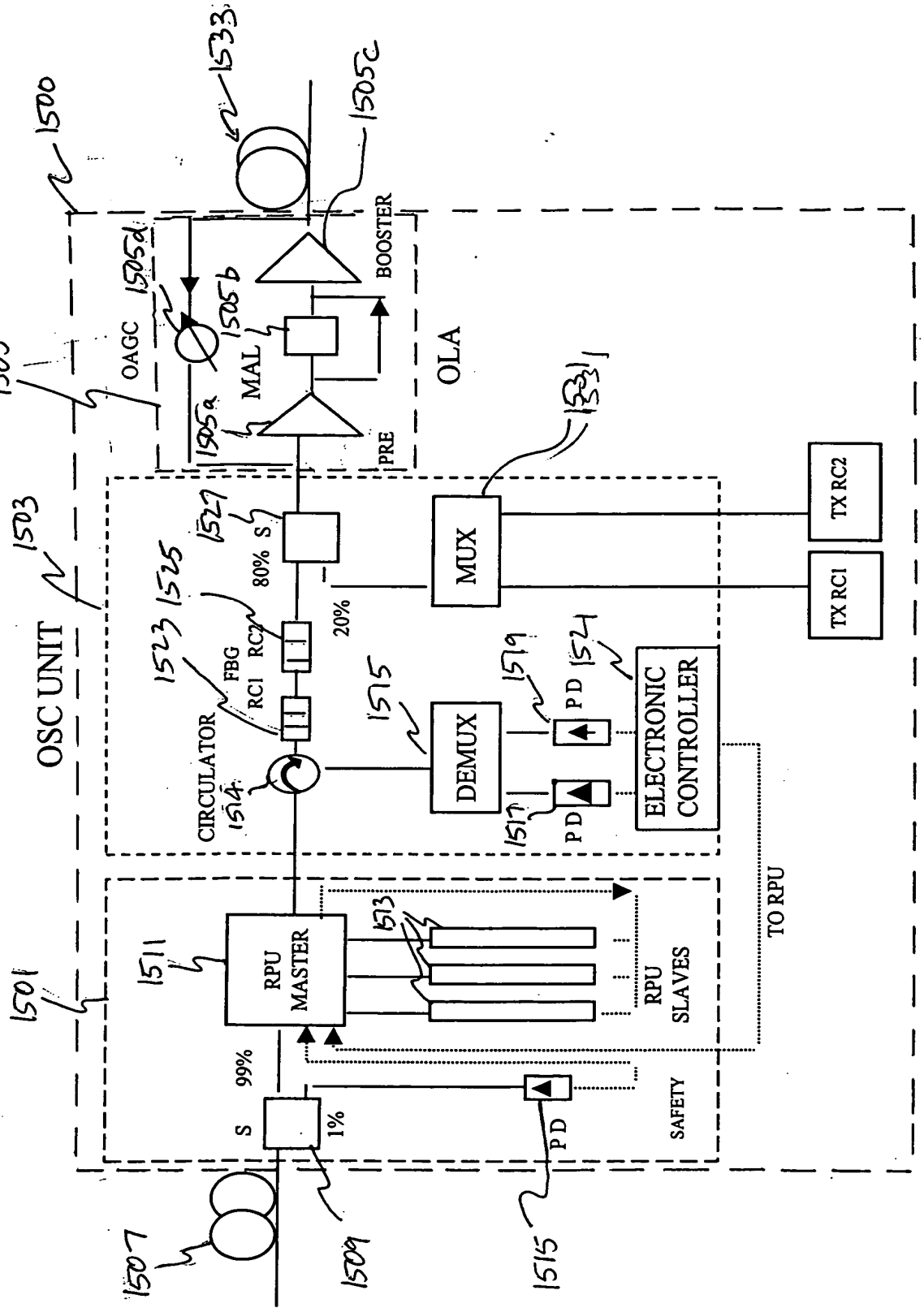

1500
1533
1505c
BOOSTER
1505d
1505b
OAGC
MAL
1505a
PRE
1505
OLA
1531
1503
OSC UNIT
1527
80% S
20%
1525
1523
FBG
RC1
RC2
CIRCULATOR
1514
MUX
TX RC2
TX RC1
DEMUX
1519
PD
1524
ELECTRONIC CONTROLLER
1517
PD
TO RPU
1501
1511
RPU MASTER
1513
RPU SLAVES
99%
S
1%
PD
SAFETY
1507
1509
1515

FIG. 15

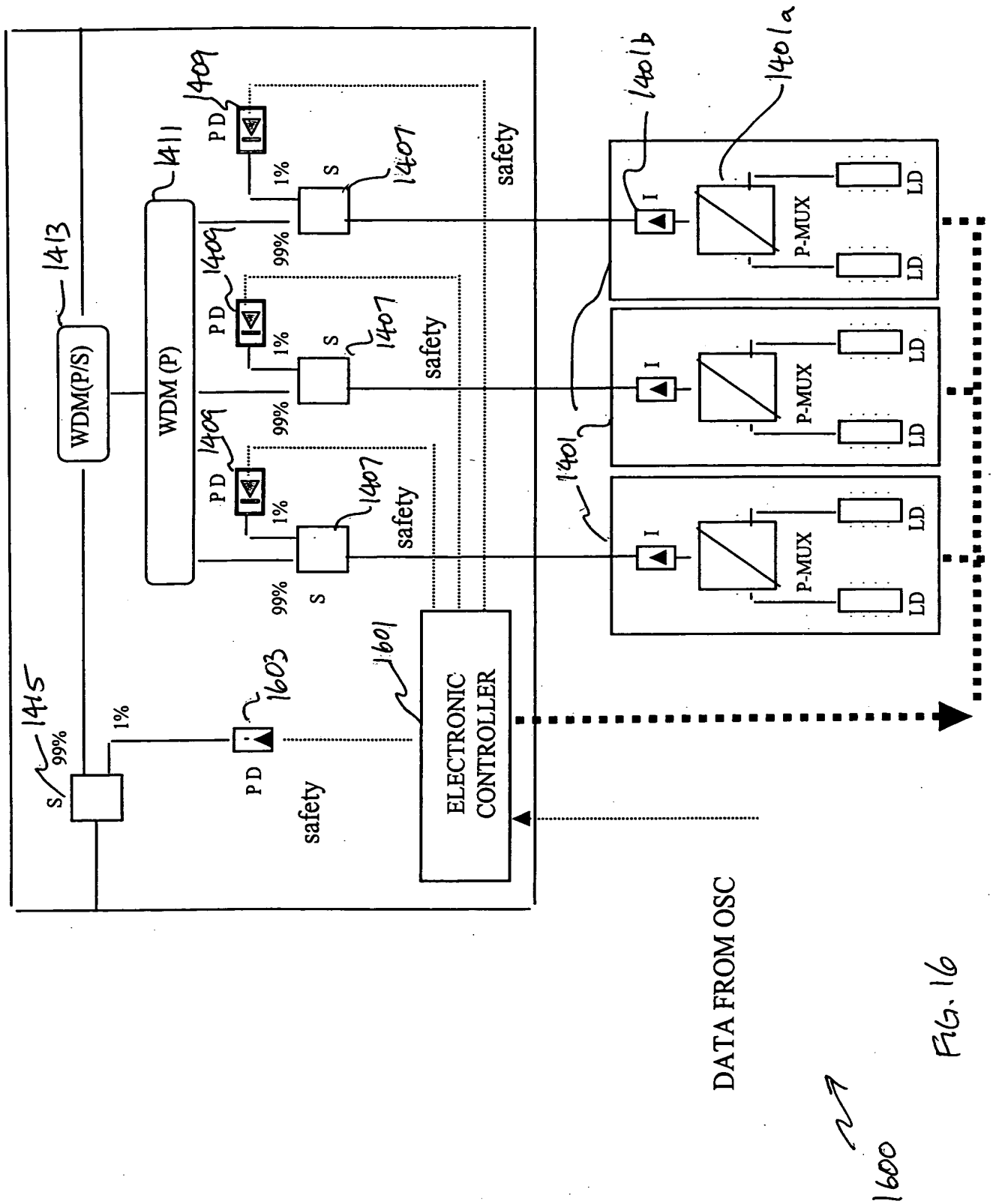

1600
1401
1401a
1401b
1403
1405
1407
1409
1411
1413
1601
WDM(P/S)
WDM (P)
P-MUX
LD
PD
I
S
1%
99%
safety
ELECTRONIC CONTROLLER
DATA FROM OSC

Fig. 16

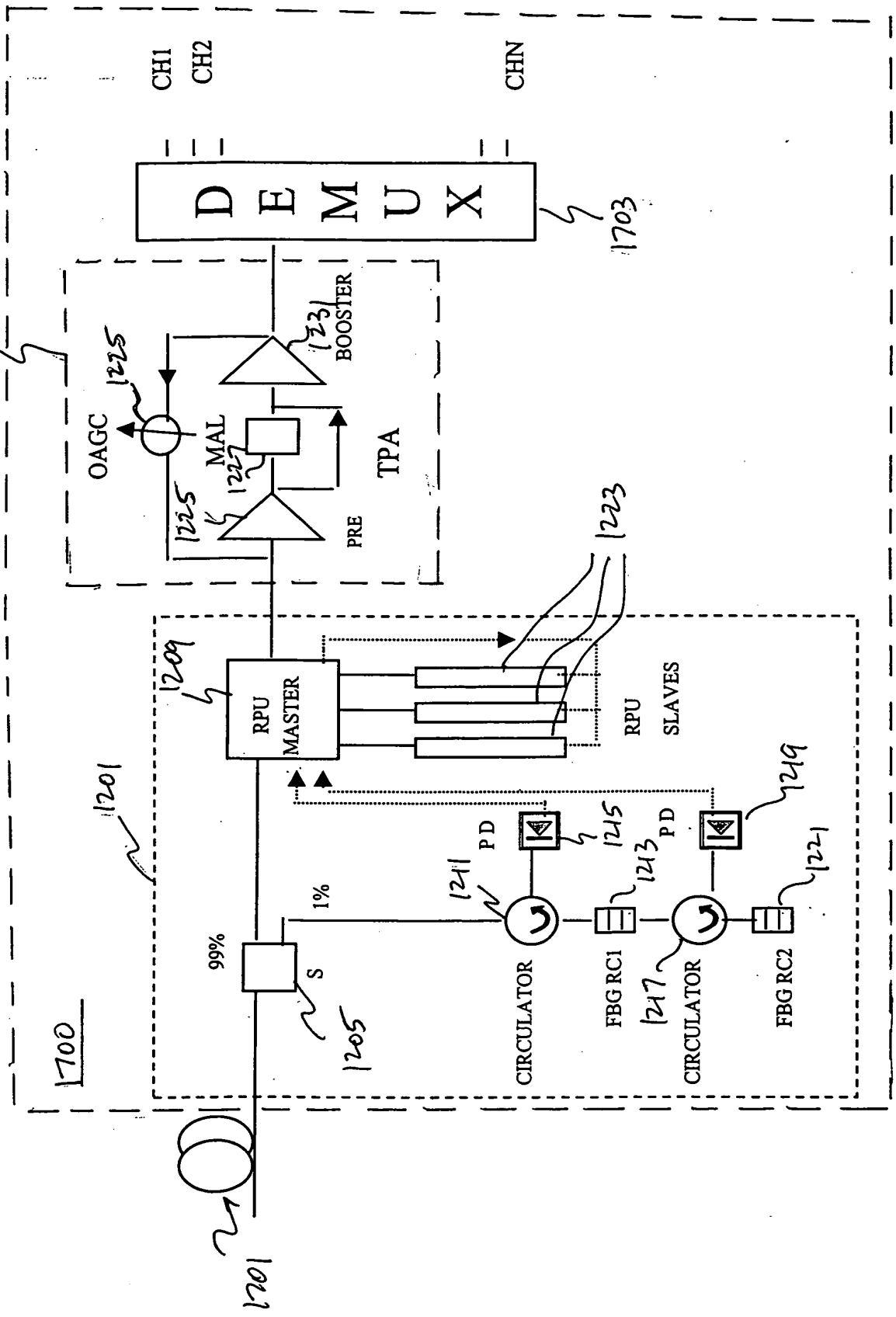

CH1
CH2
CHN
DEMUX
1703
1203
OAGC
1225
MAL
1227
TPA
PRE
BOOSTER
1231
1223
1209
RPU MASTER
RPU SLAVES
1201
1700
99%
1%
S
1205
1241
PD
1245
1243
PD
1249
1221
CIRCULATOR
FBG RC1
1247
CIRCULATOR
FBG RC2
1701

FIG. 17

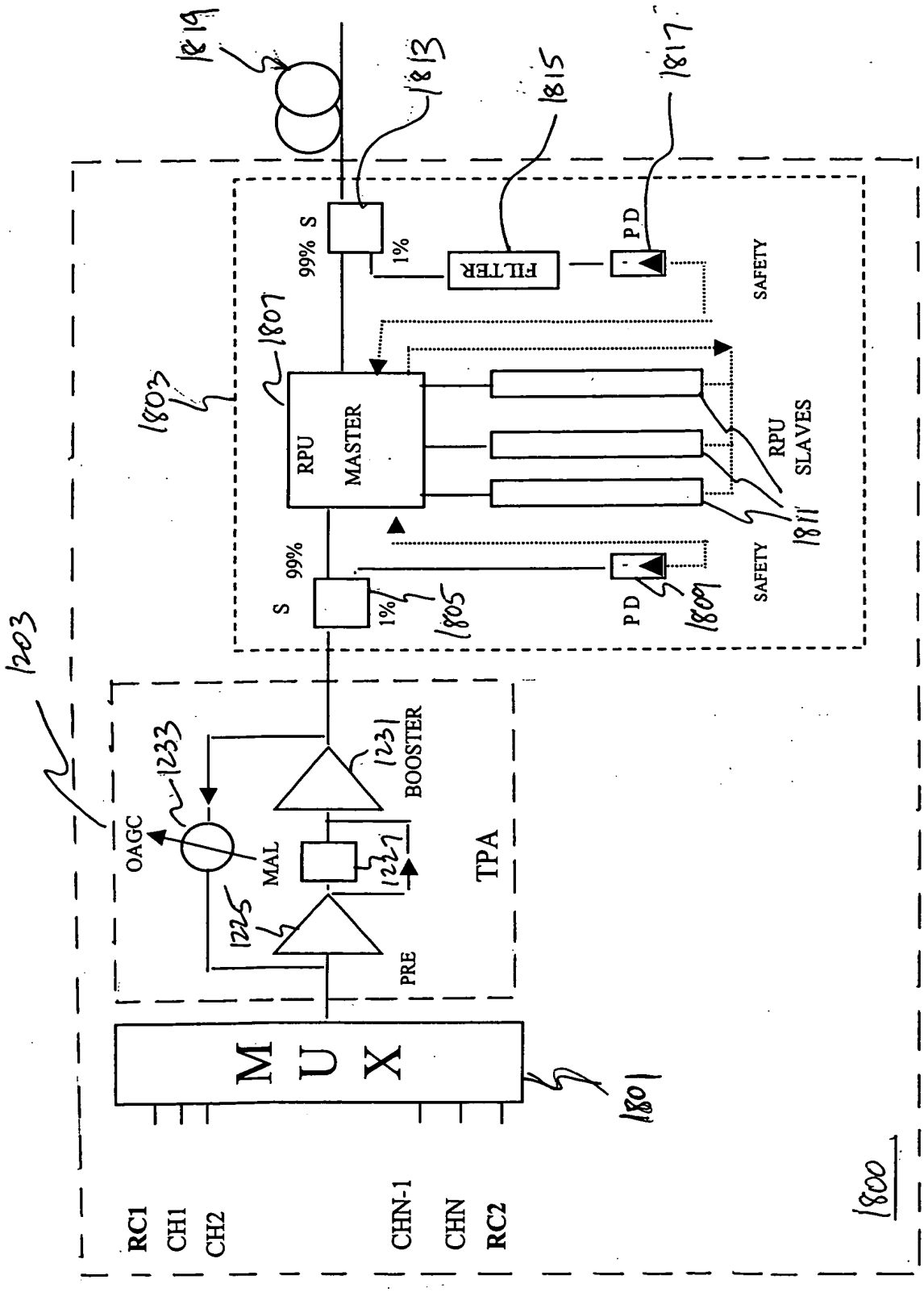

1819
1813
1815
1817
99% S
1%
FILTER
PD
SAFETY
1807
1803
RPU MASTER
RPU SLAVES
1811
S 99%
1%
1805
PD
1809
SAFETY
1203
1233
1231
BOOSTER
OAGC
MAL
1227
1225
TPA
PRE
M U X
1801
RC1
CH1
CH2
CHN-1
CHN
RC2
1800

FIG. 18

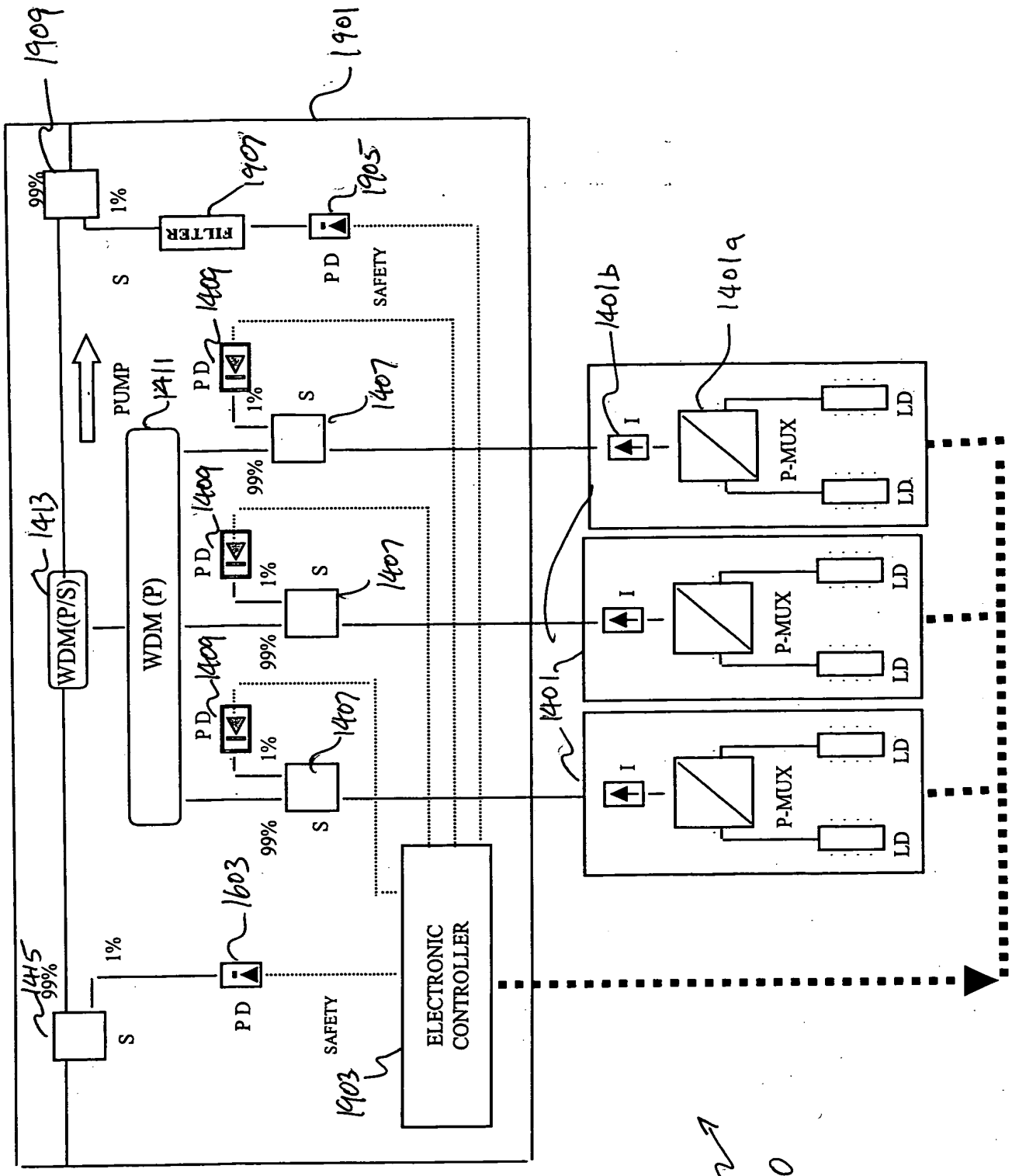

1909
1901
99%
1%
FILTER
1907
1905
PD
SAFETY
S
1409
PD
1%
S
1407
99%
PUMP
1411
1413
WDM(P/S)
WDM (P)
1409
PD
1%
S
1407
99%
1409
PD
1%
S
1407
99%
1603
1445
99%
1%
PD
SAFETY
S
1903
ELECTRONIC CONTROLLER
1401b
1401a
1401
I
P-MUX
LD
LD
I
P-MUX
LD
LD
I
P-MUX
LD
LD
1900

FIG. 19

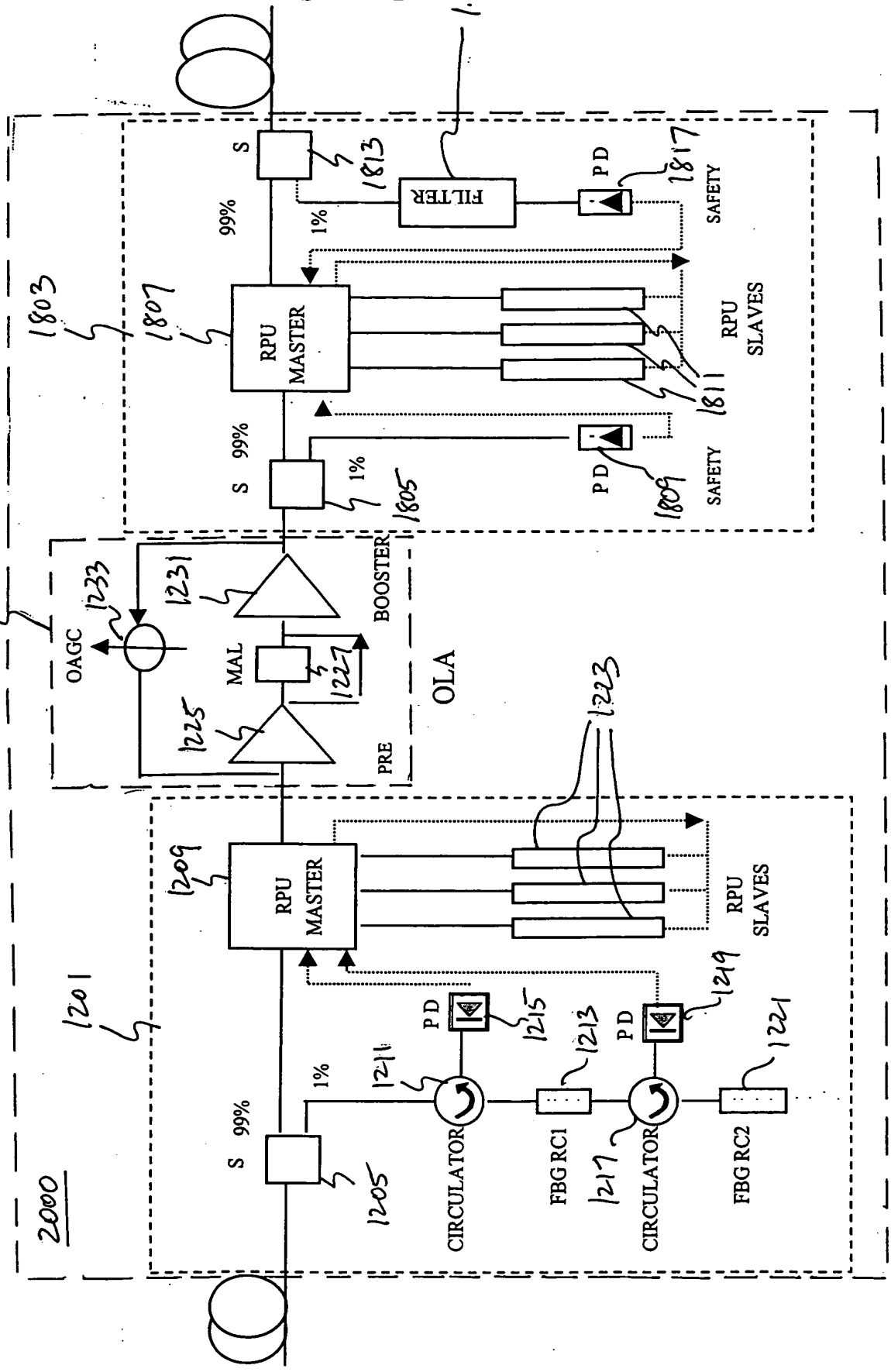

2000
1201
1203
1205
1207
1209
1211
1213
1215
1217
1219
1221
1223
1225
1227
1231
1233
1803
1805
1807
1809
1811
1813
1817
S
99%
1%
PD
FILTER
SAFETY
RPU MASTER
RPU SLAVES
OLA
BOOSTER
PRE
MAL
OAGC
CIRCULATOR
FBG RC1
FBG RC2

FIG. 20

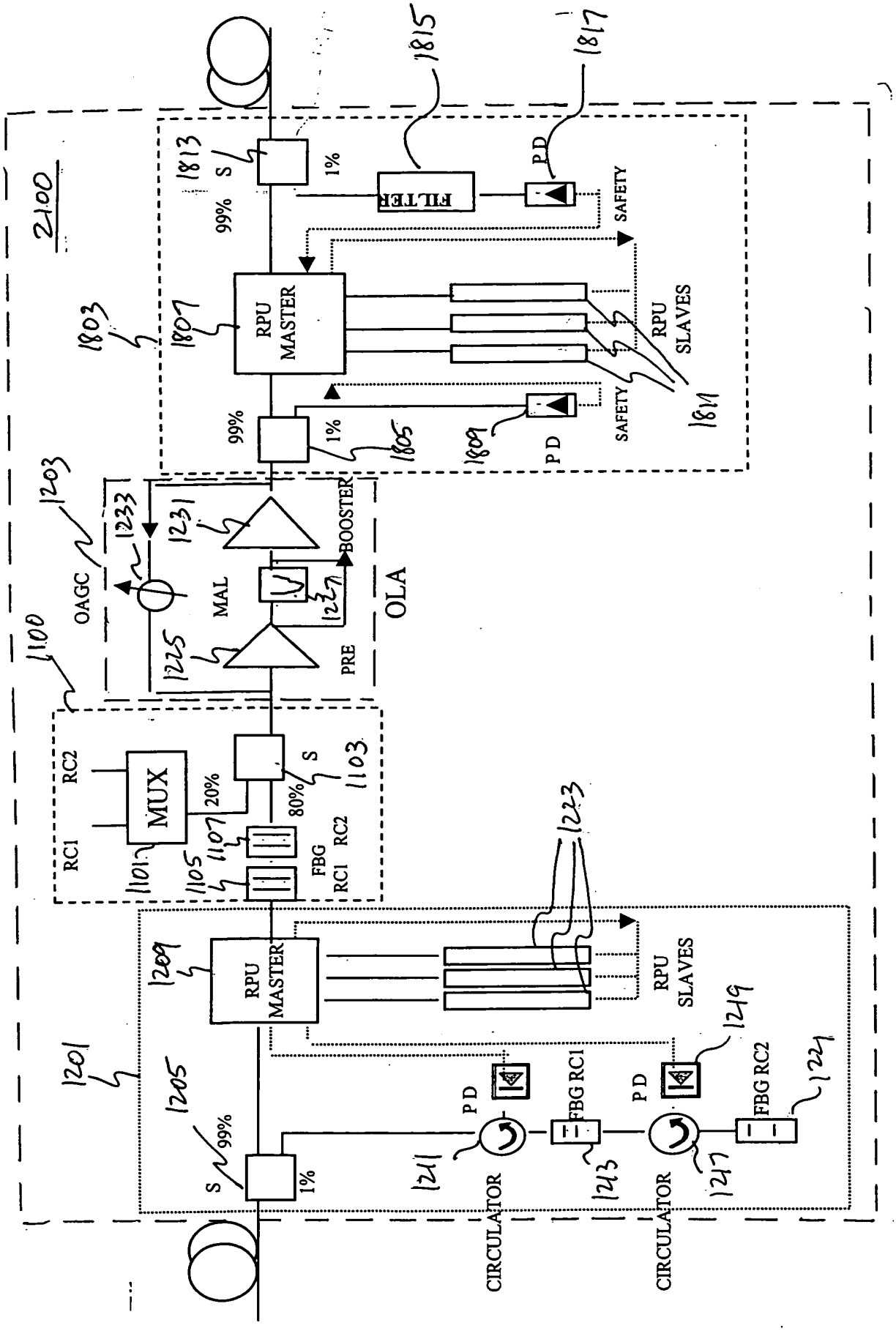

2100
1803
1807
RPU MASTER
1813
S
99%
1%
1815
FILTER
1817
PD
SAFETY
RPU SLAVES
1811
1809
1805
1203
1233
1231
BOOSTER
OAGC
MAL
1227
OLA
1225
PRE
1100
RC2
RC1
MUX
1101
20%
80%
1107
1105
FBG RC1 RC2
1103
1223
1209
1201
1205
1249
1241
1243
1247
1245
CIRCULATOR
CIRCULATOR
FBG RC1
FBG RC2

Fig. 21

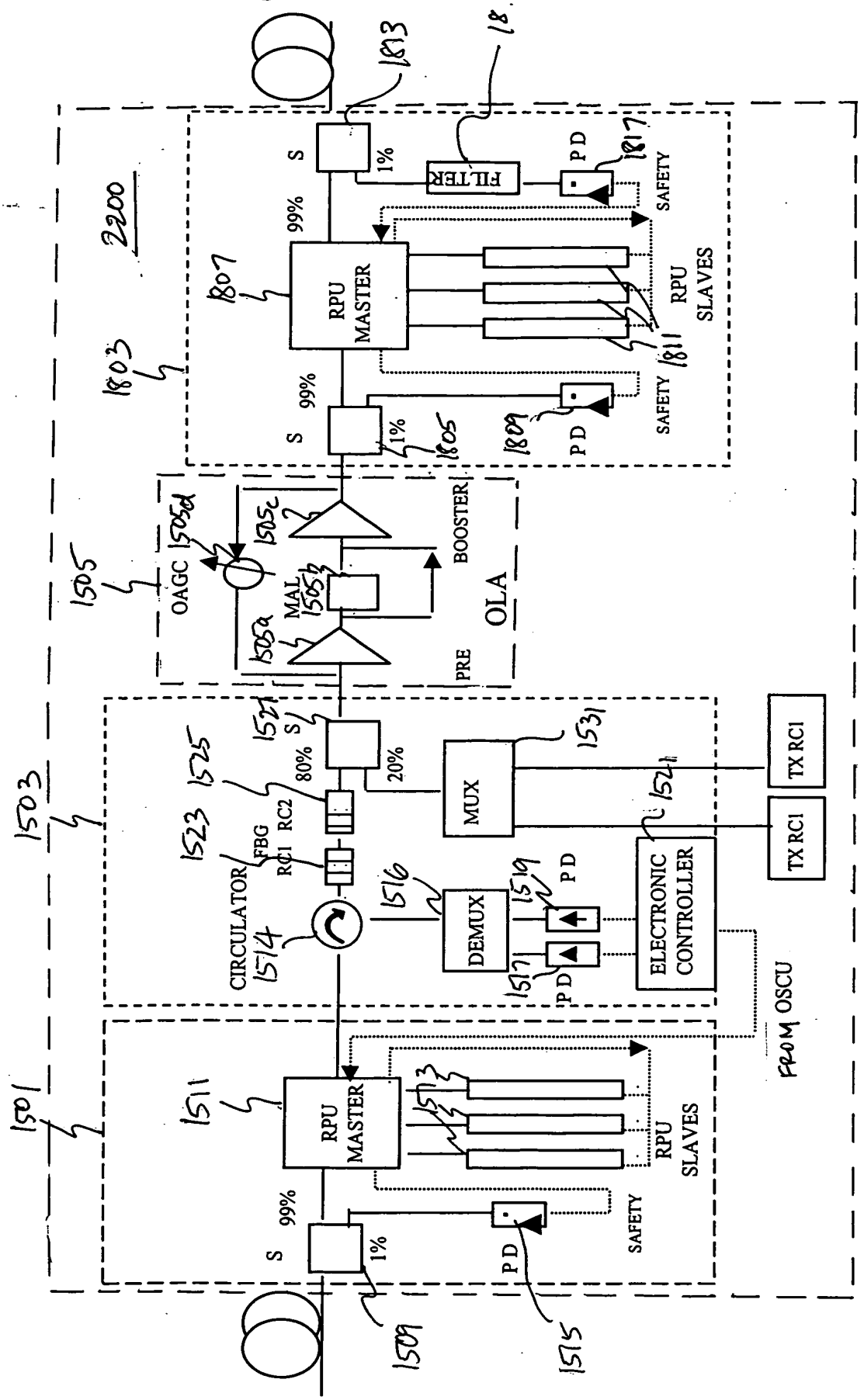

2200
1803
1807
RPU MASTER
RPU SLAVES
SAFETY
PD
FILTER
1817
1813
1811
1809
1805
99%
1%
S
1505
OAGC
1505d
1505c
1505b
MAL
BOOSTER
PRE
OLA
1503
1525
1523
FBG
RC1
RC2
CIRCULATOR
1514
1516
DEMUX
1519
1517
1521
80%
20%
MUX
1531
1524
TX RC1
TX RC1
ELECTRONIC CONTROLLER
FROM OSCU
1501
1511
1513
1509
1515

FIG. 22

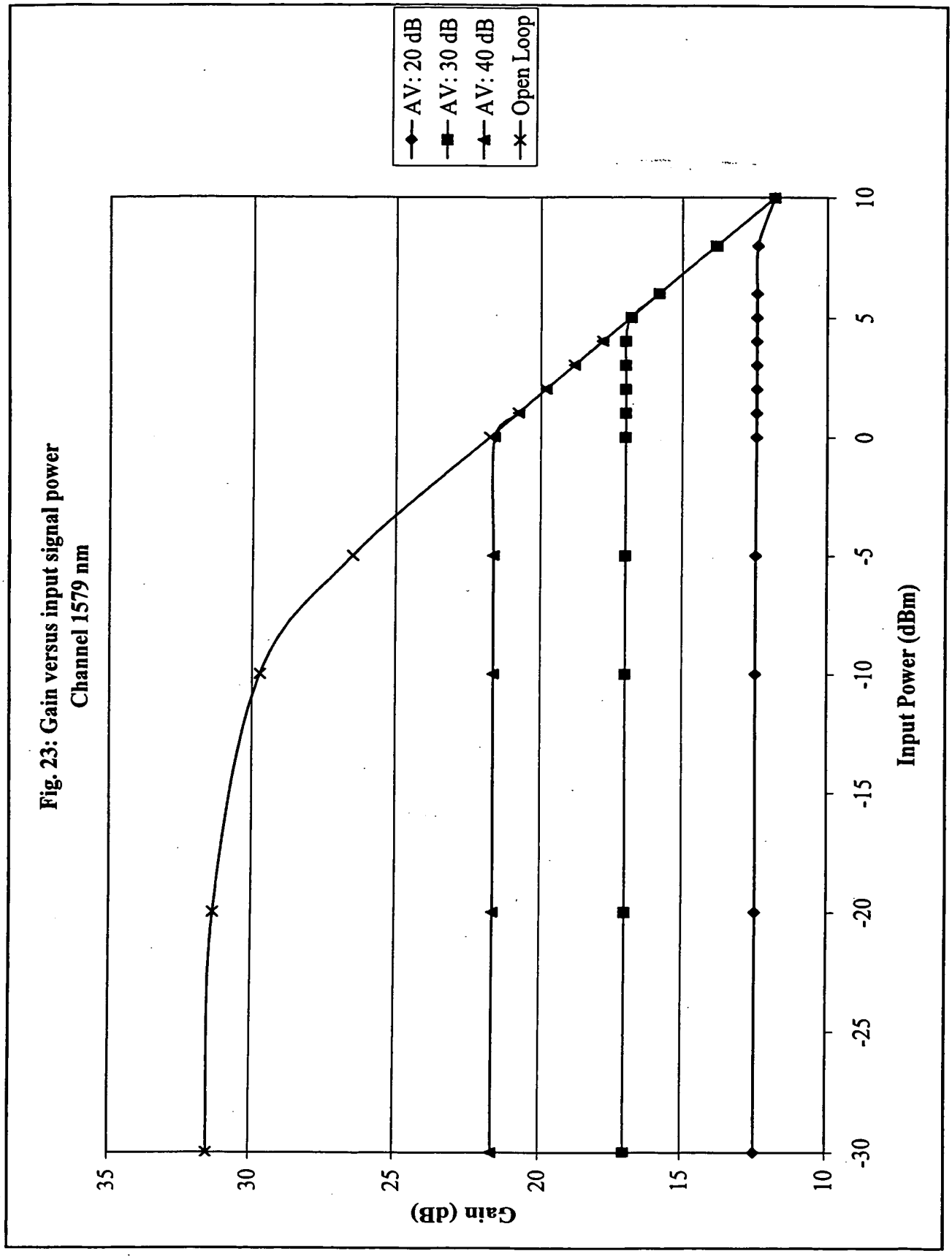


Fig. 23: Gain versus input signal power
Channel 1579 nm

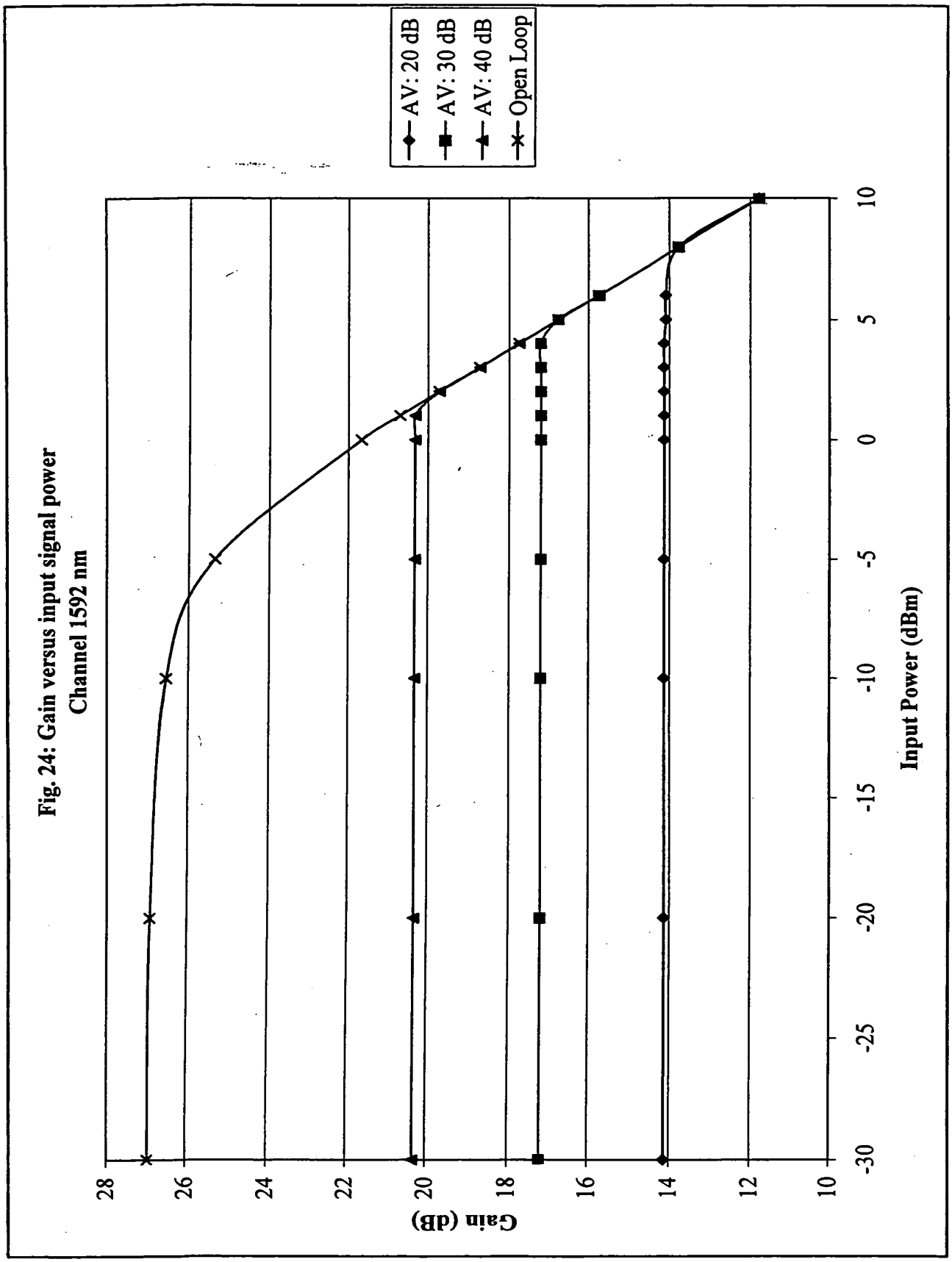


Fig. 24: Gain versus input signal power
Channel 1592 nm

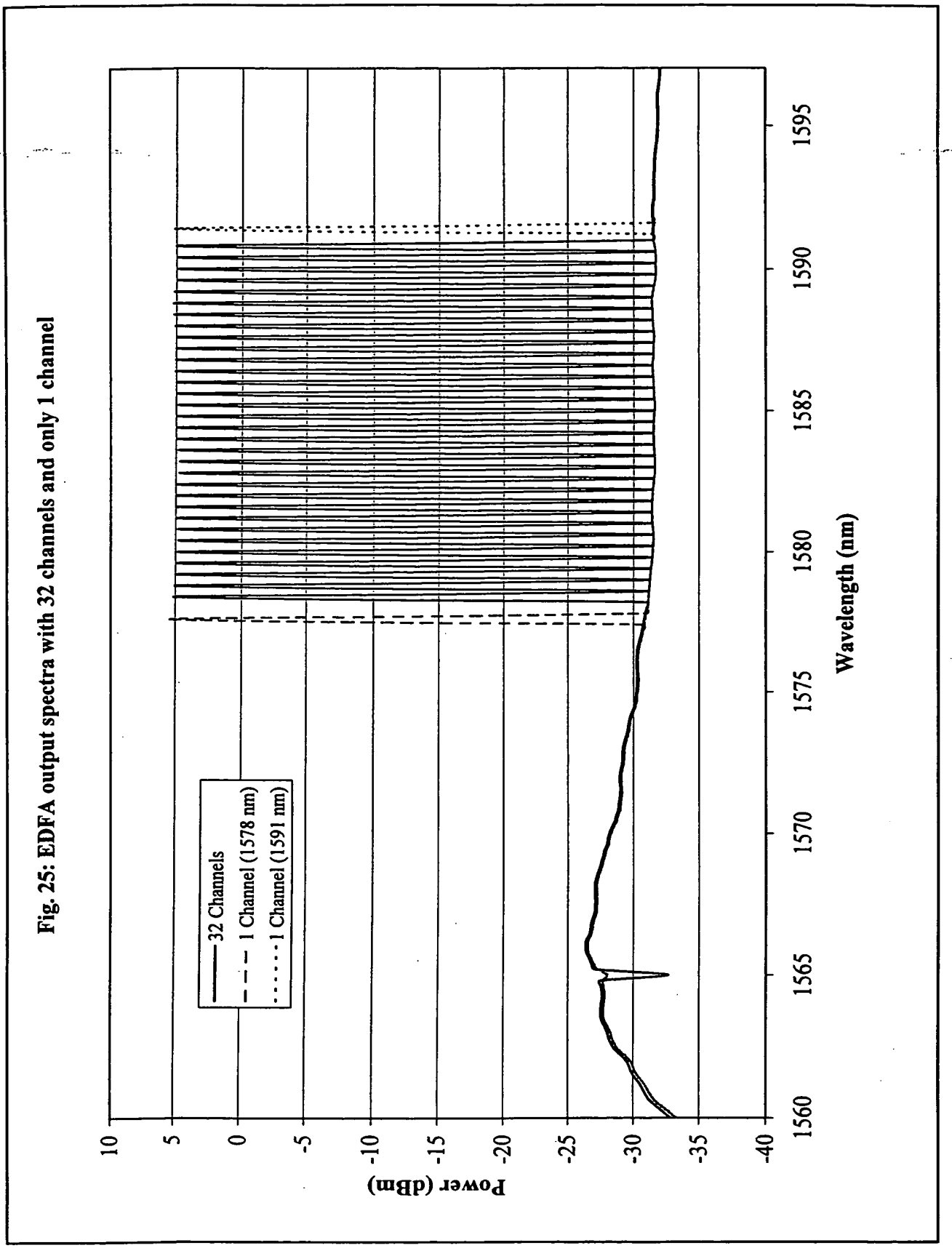


Fig. 25: EDFA output spectra with 32 channels and only 1 channel

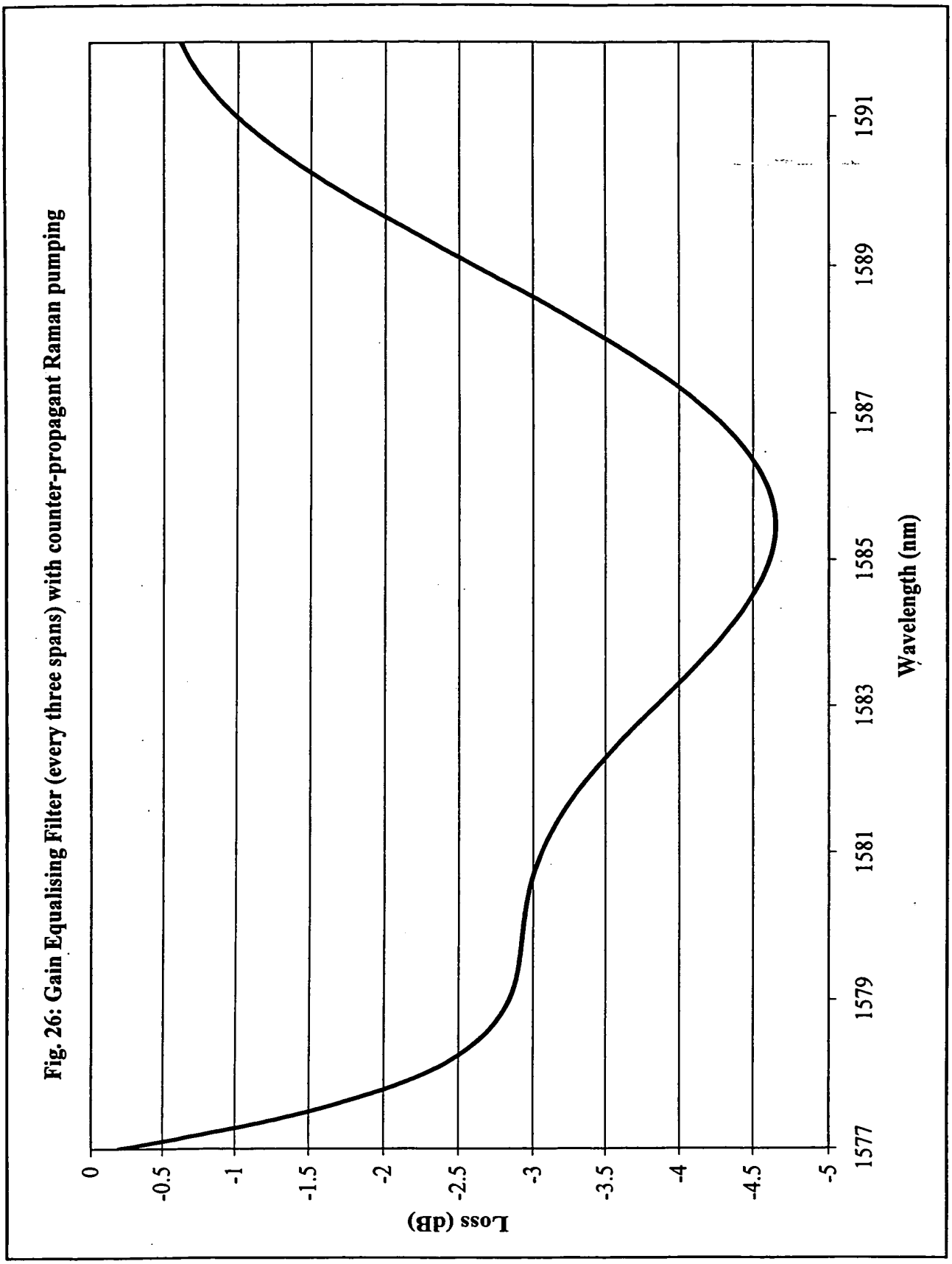


Fig. 26: Gain Equalising Filter (every three spans) with counter-propagant Raman pumping

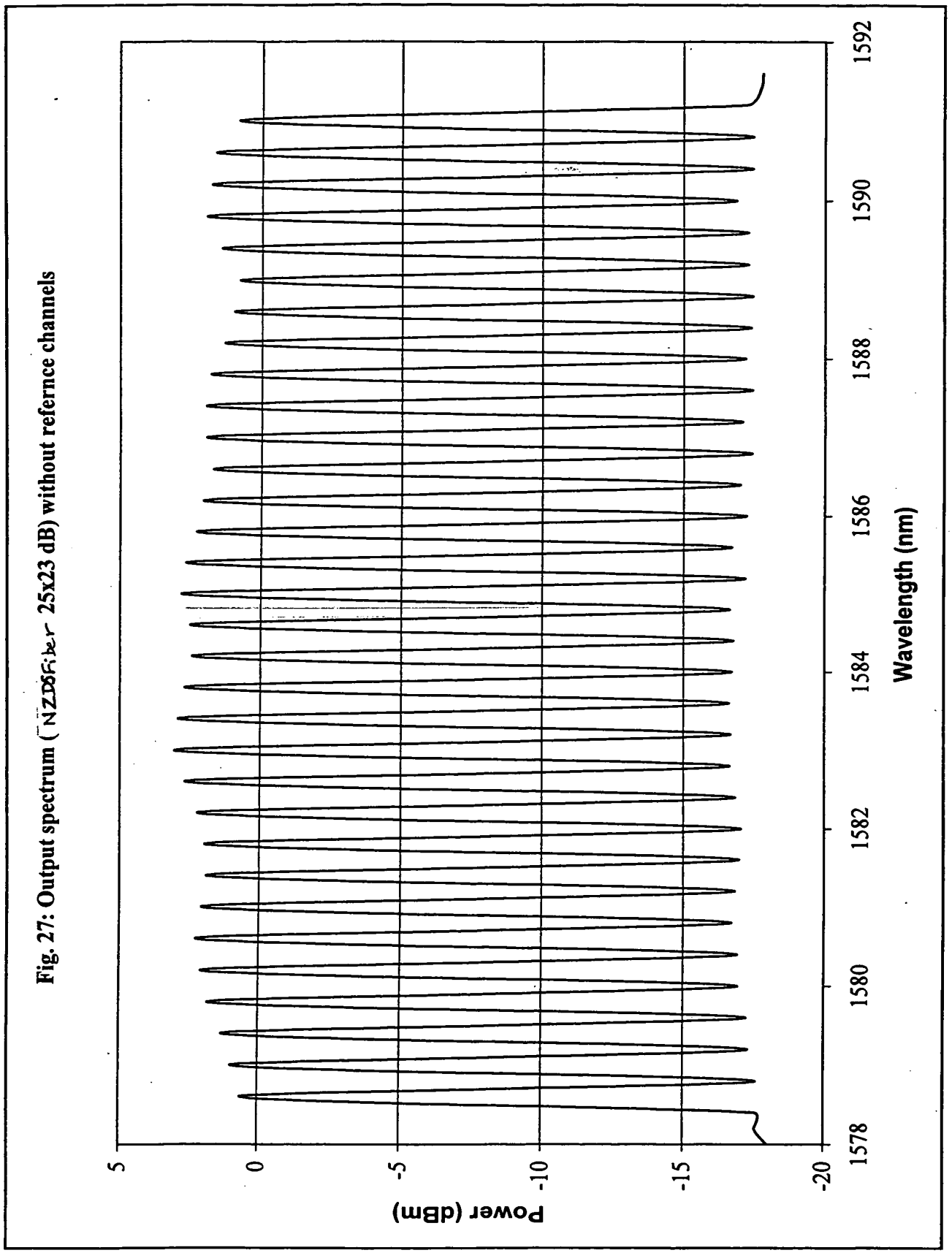


Fig. 27: Output spectrum (NZDSfiber 25x23 dB) without refernce channels

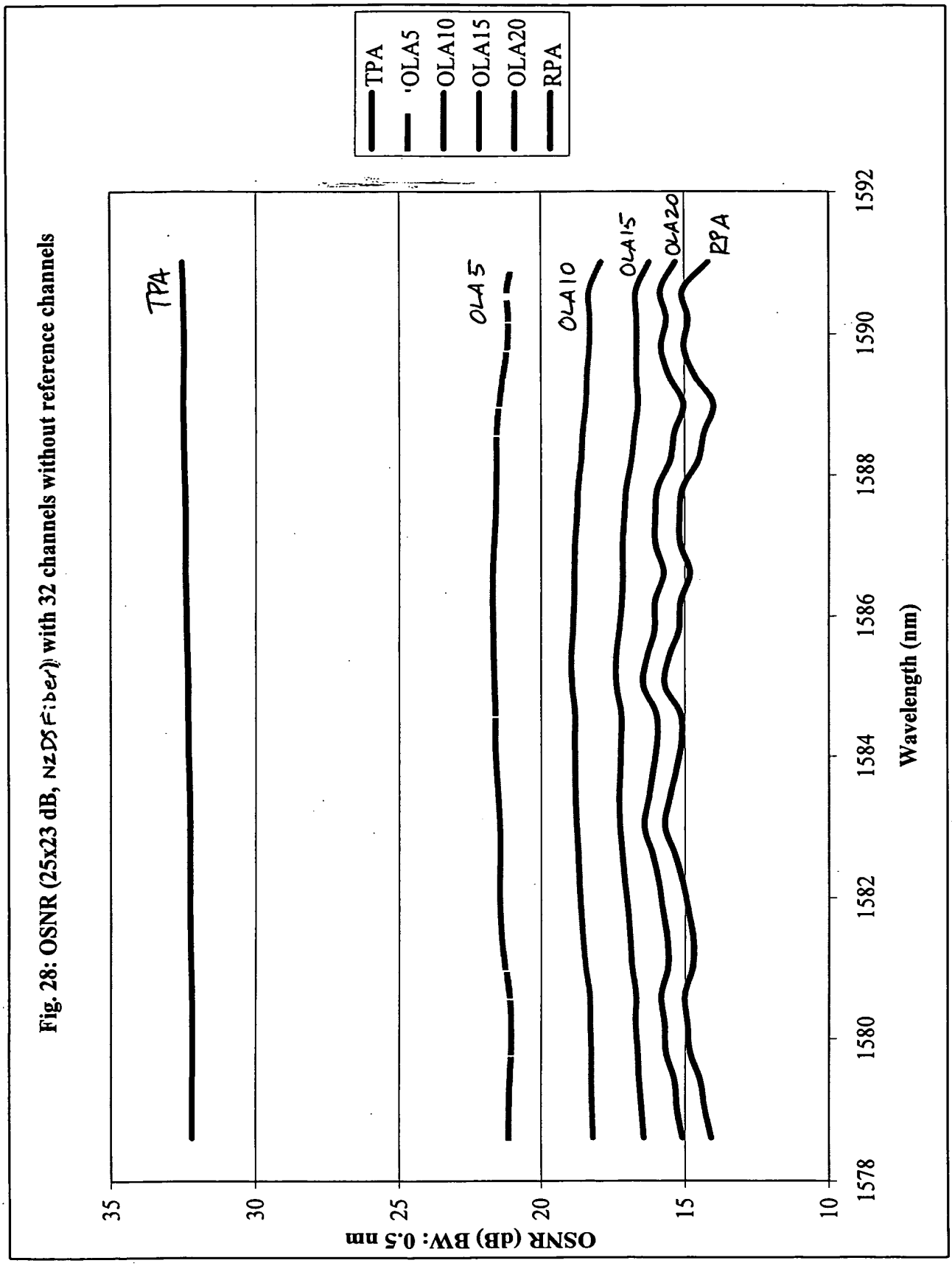


Fig. 28: OSNR (25x23 dB, NZDSFiber) with 32 channels without reference channels

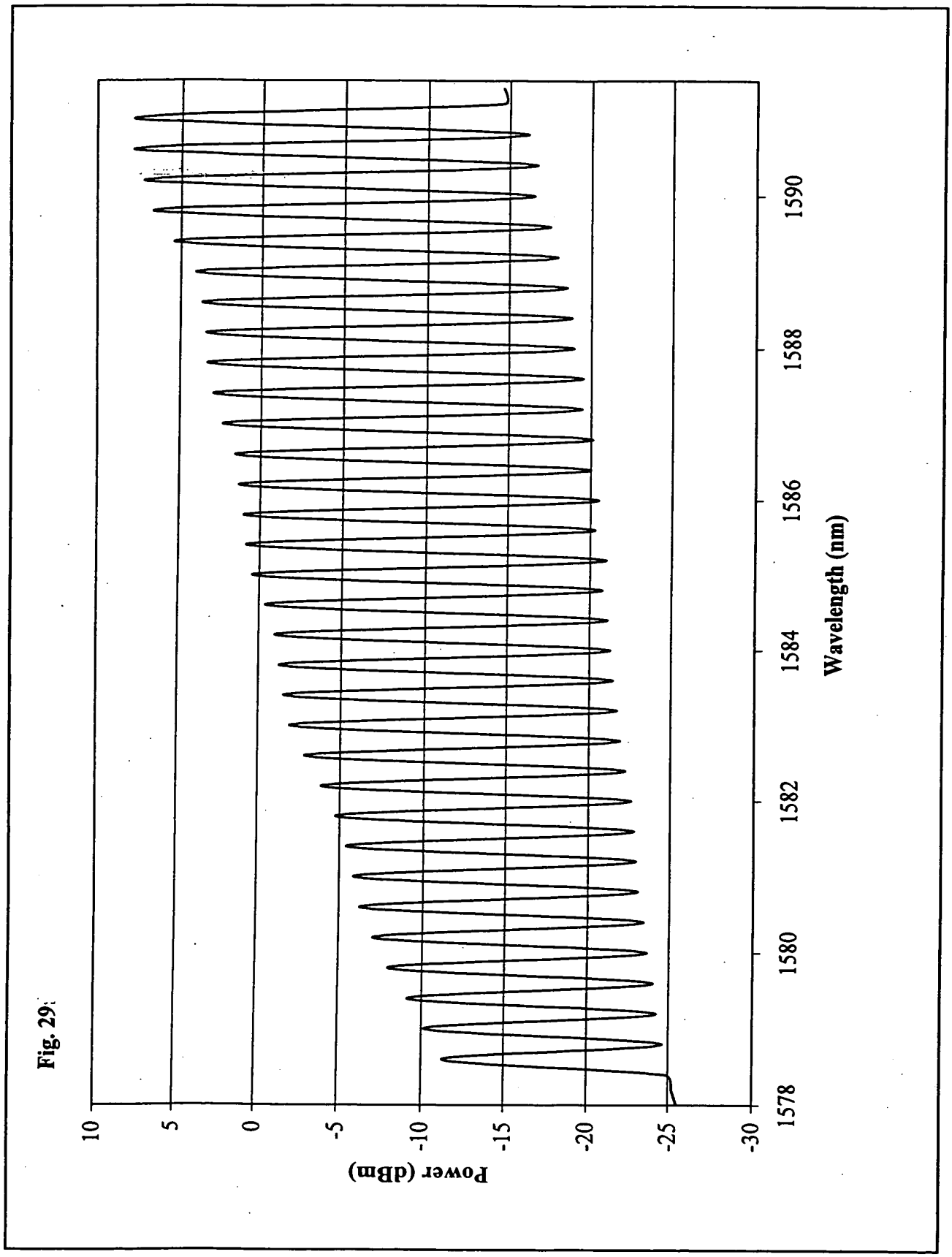

Power (dBm)
10
5
0
-5
-10
-15
-20
-25
-30
1578
1580
1582
1584
1586
1588
1590
Wavelength (nm)

Fig. 29

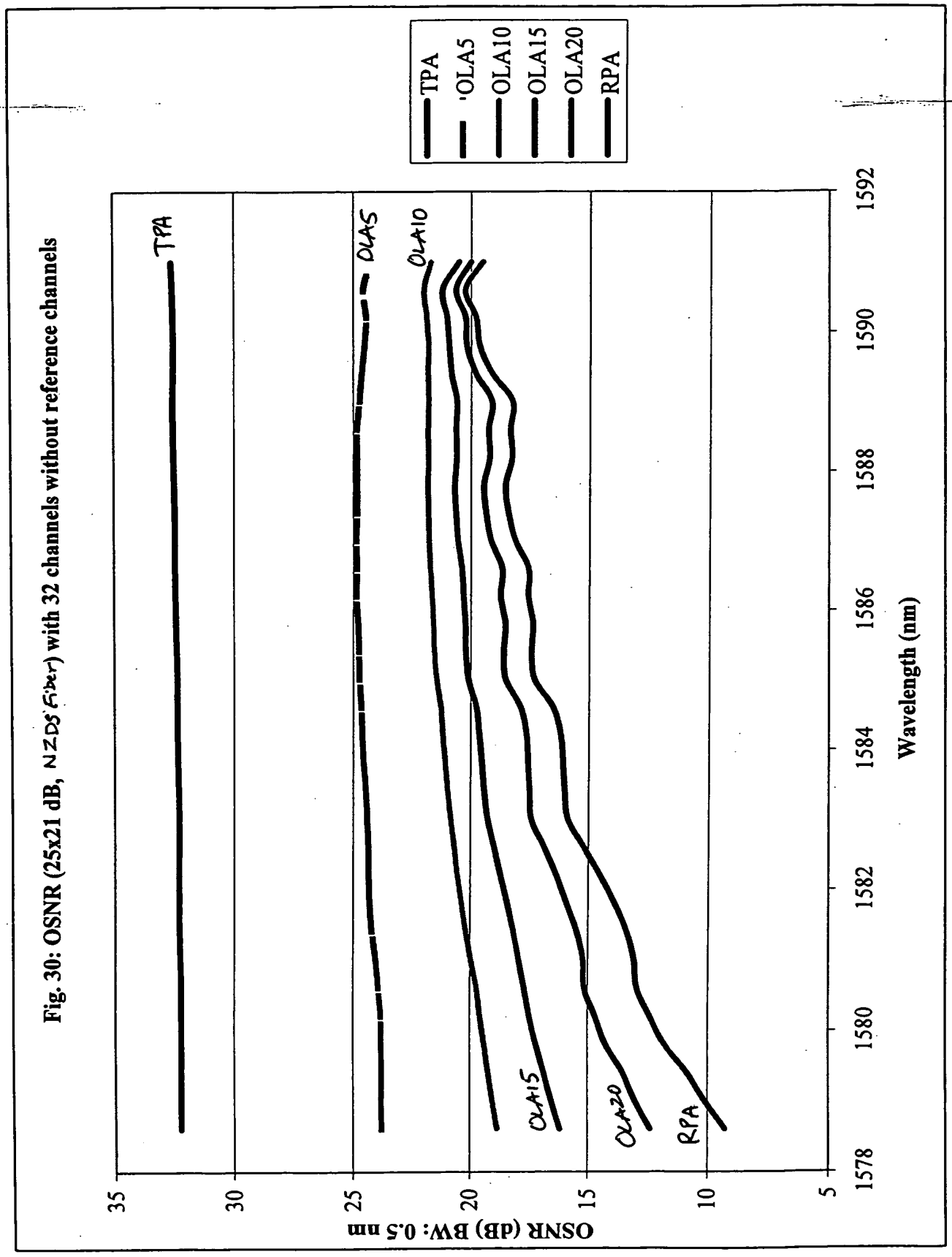


Fig. 30: OSNR (25x21 dB, NZDS fiber) with 32 channels without reference channels

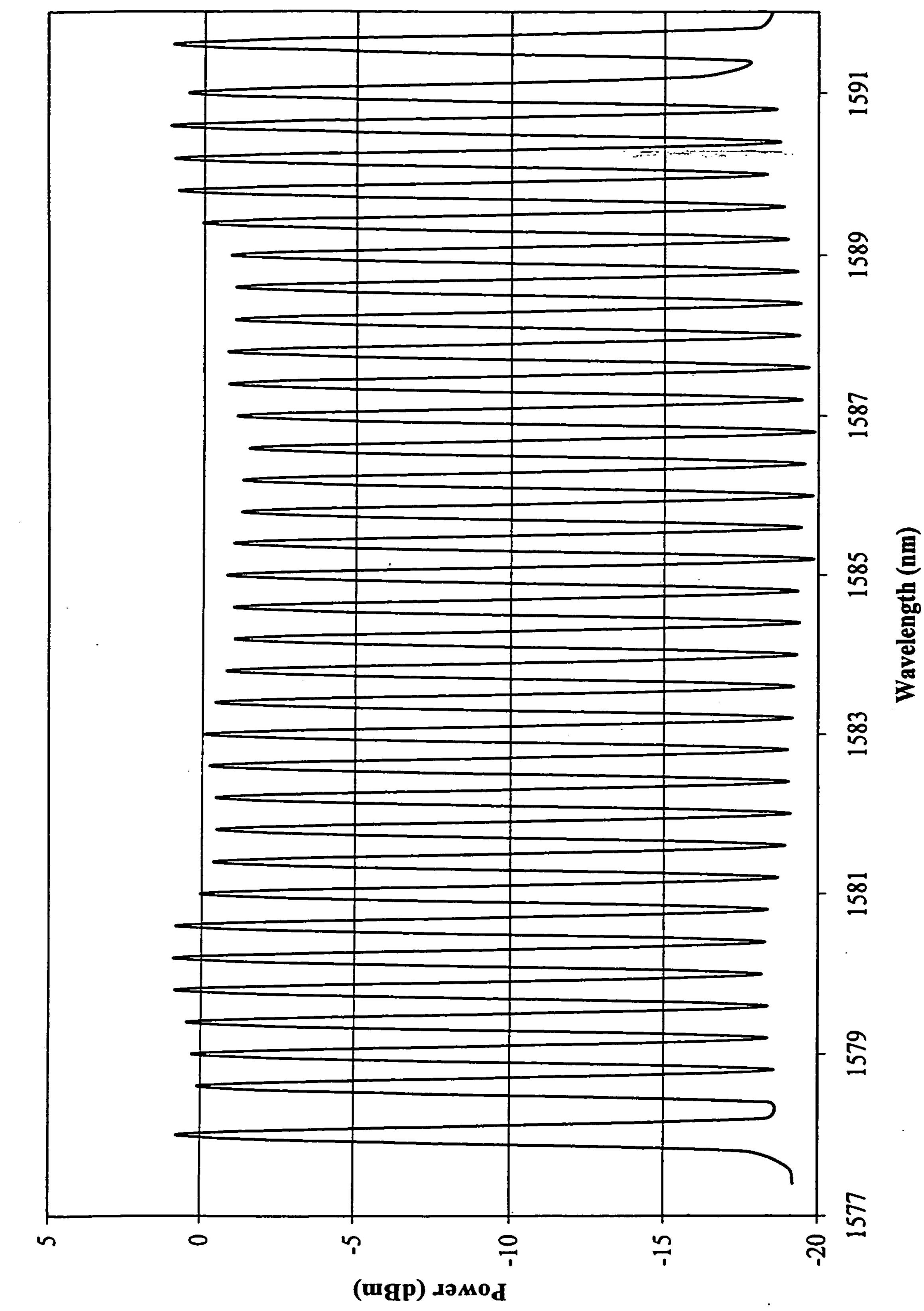


Fig. 31: Output Spectrum (25x21 dB, NZDSFiber); with 32 channels and refernce channels

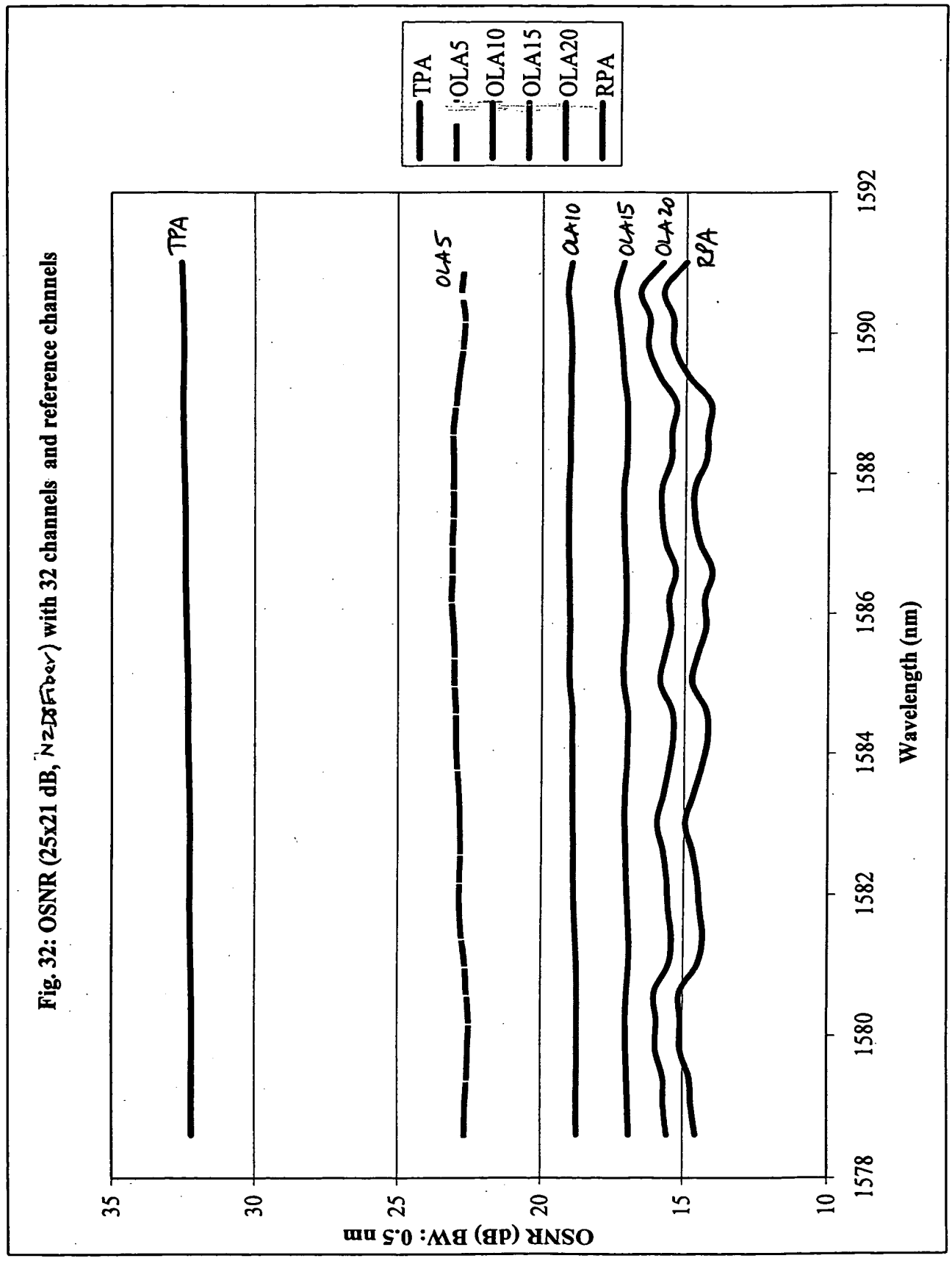


Fig. 32: OSNR (25x21 dB, NZDSFBW) with 32 channels and reference channels

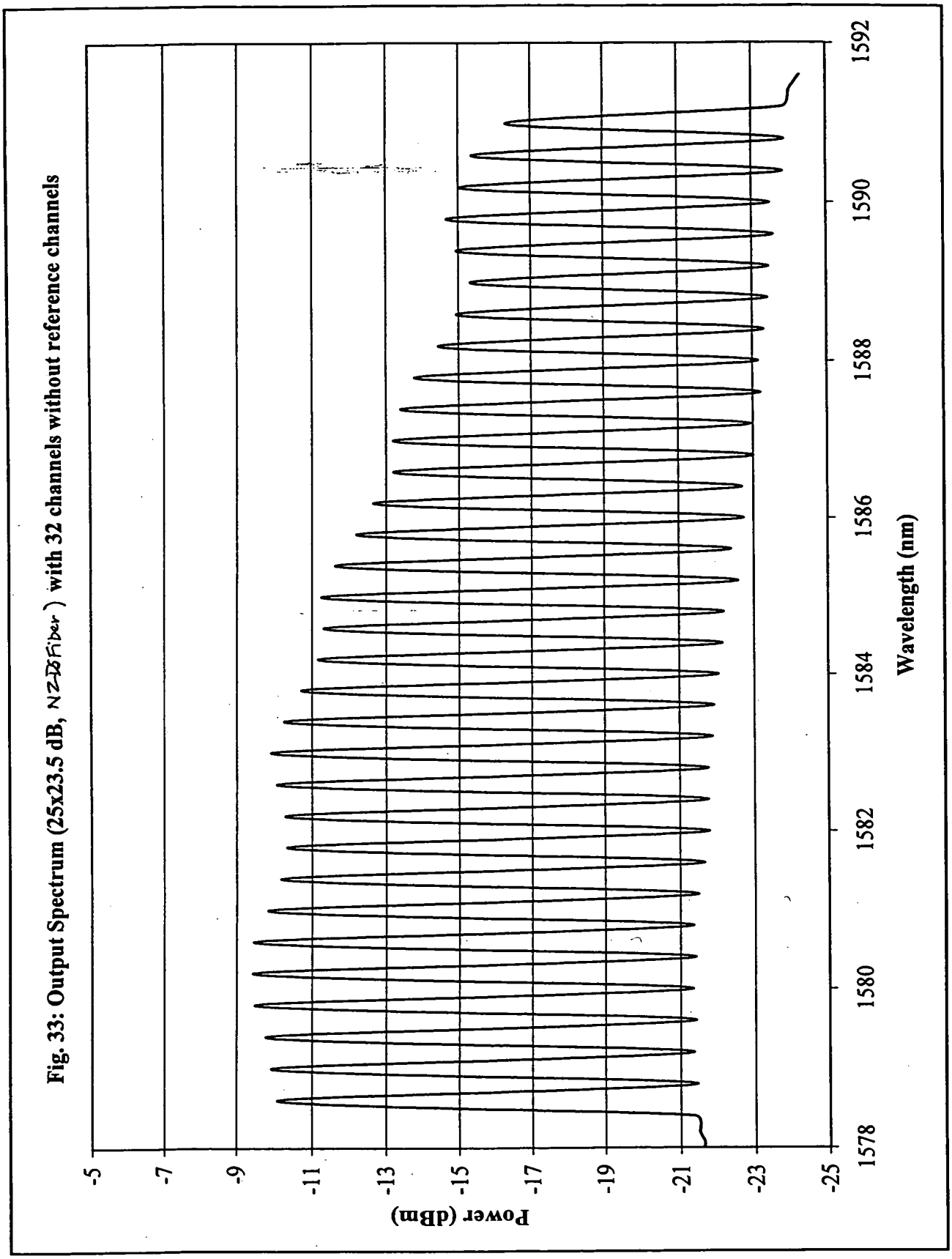


Fig. 33: Output Spectrum (25x23.5 dB, NZDFiber) with 32 channels without reference channels

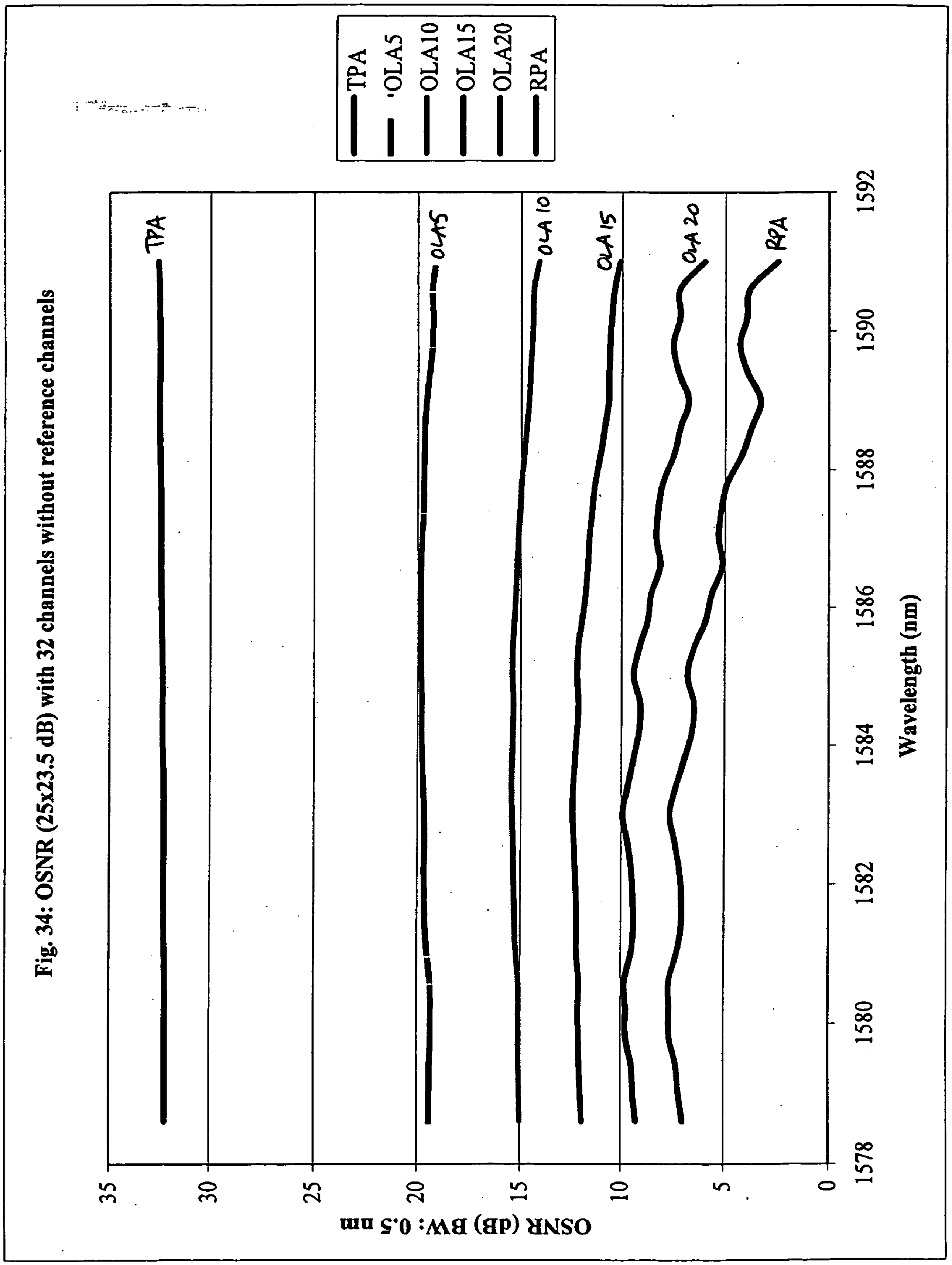


Fig. 34: OSNR (25x23.5 dB) with 32 channels without reference channels

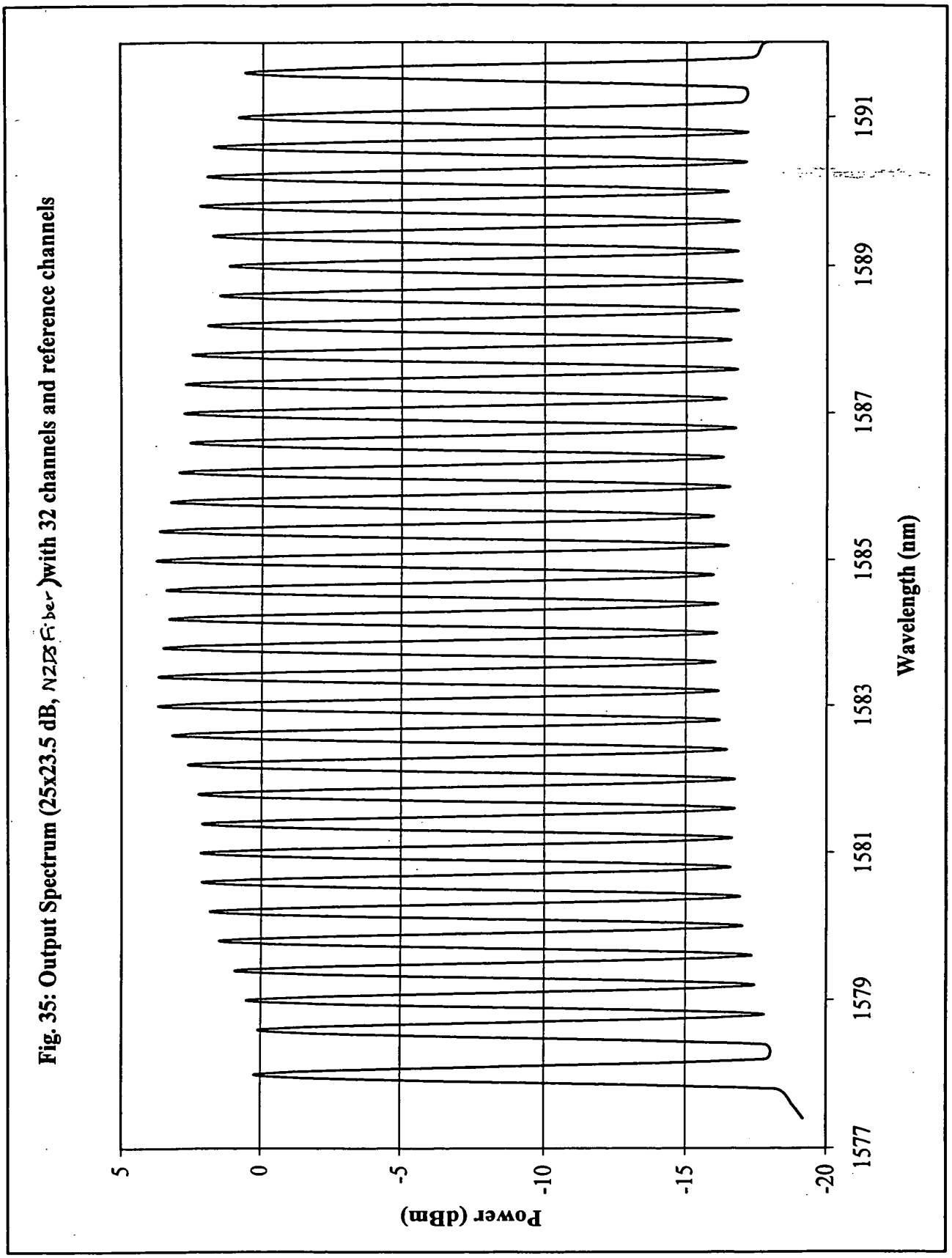


Fig. 35: Output Spectrum (25x23.5 dB, NZDSFiber) with 32 channels and reference channels

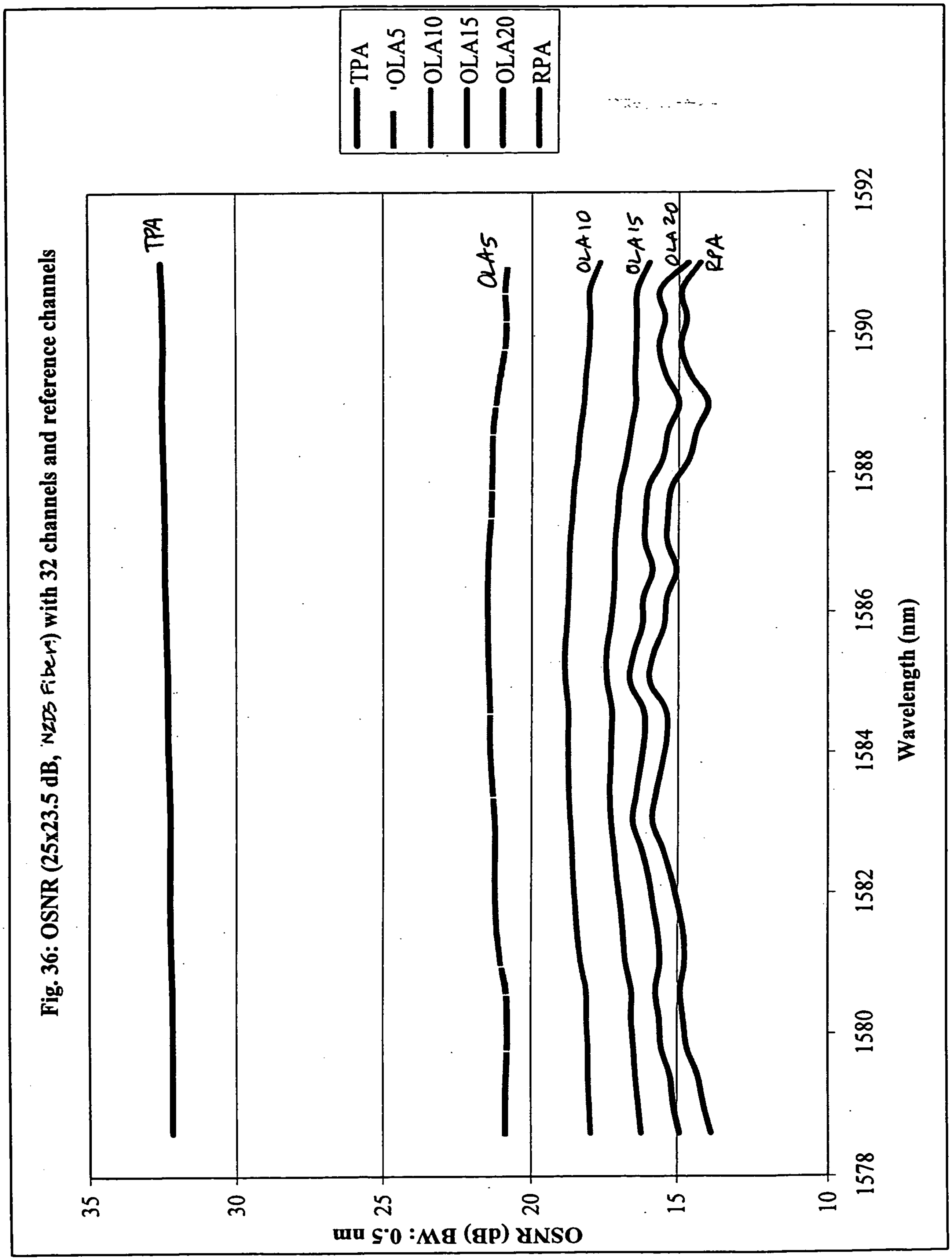


Fig. 36: OSNR (25x23.5 dB, 'NZDS Fiber') with 32 channels and reference channels

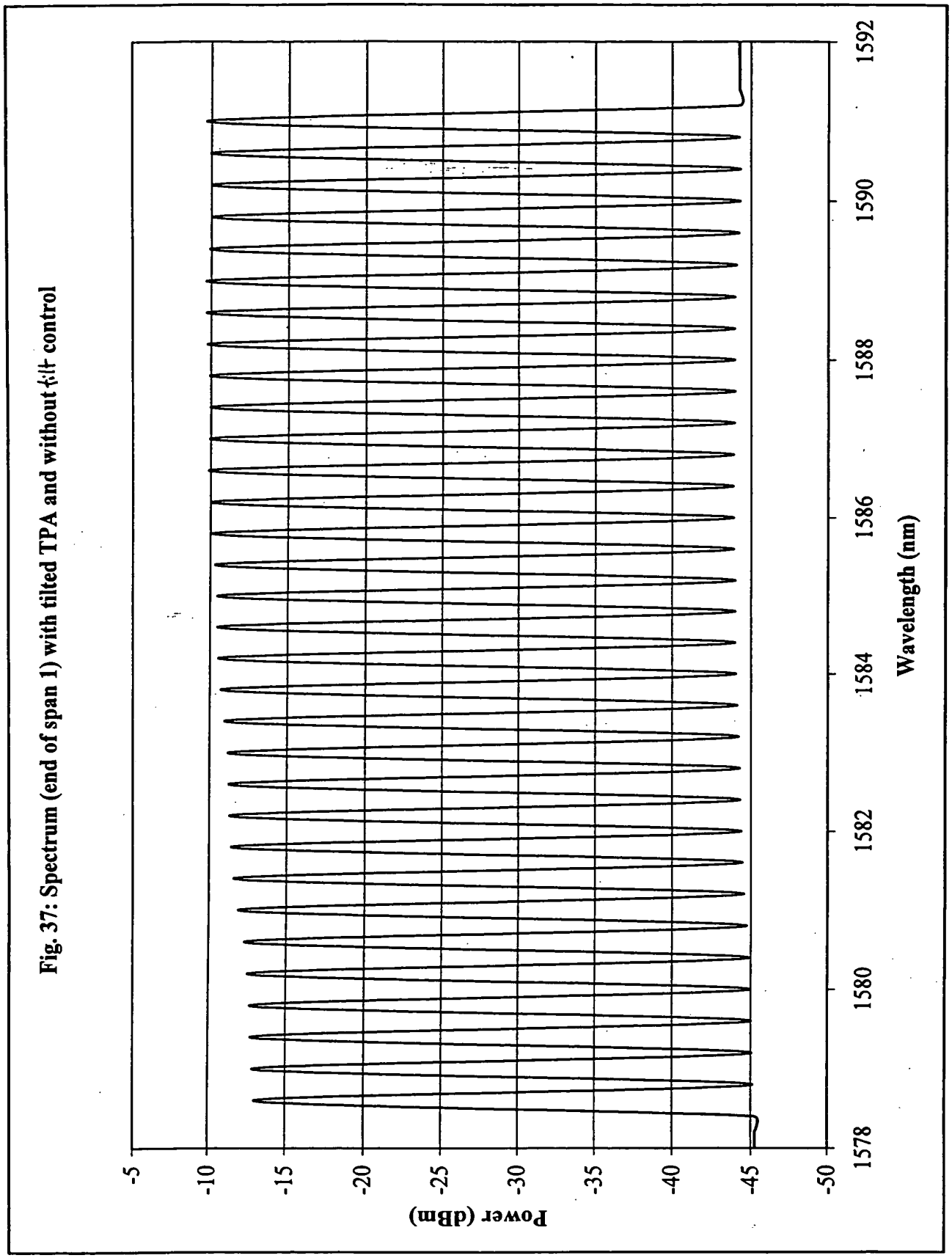


Fig. 37: Spectrum (end of span 1) with tilted TPA and without tilt control

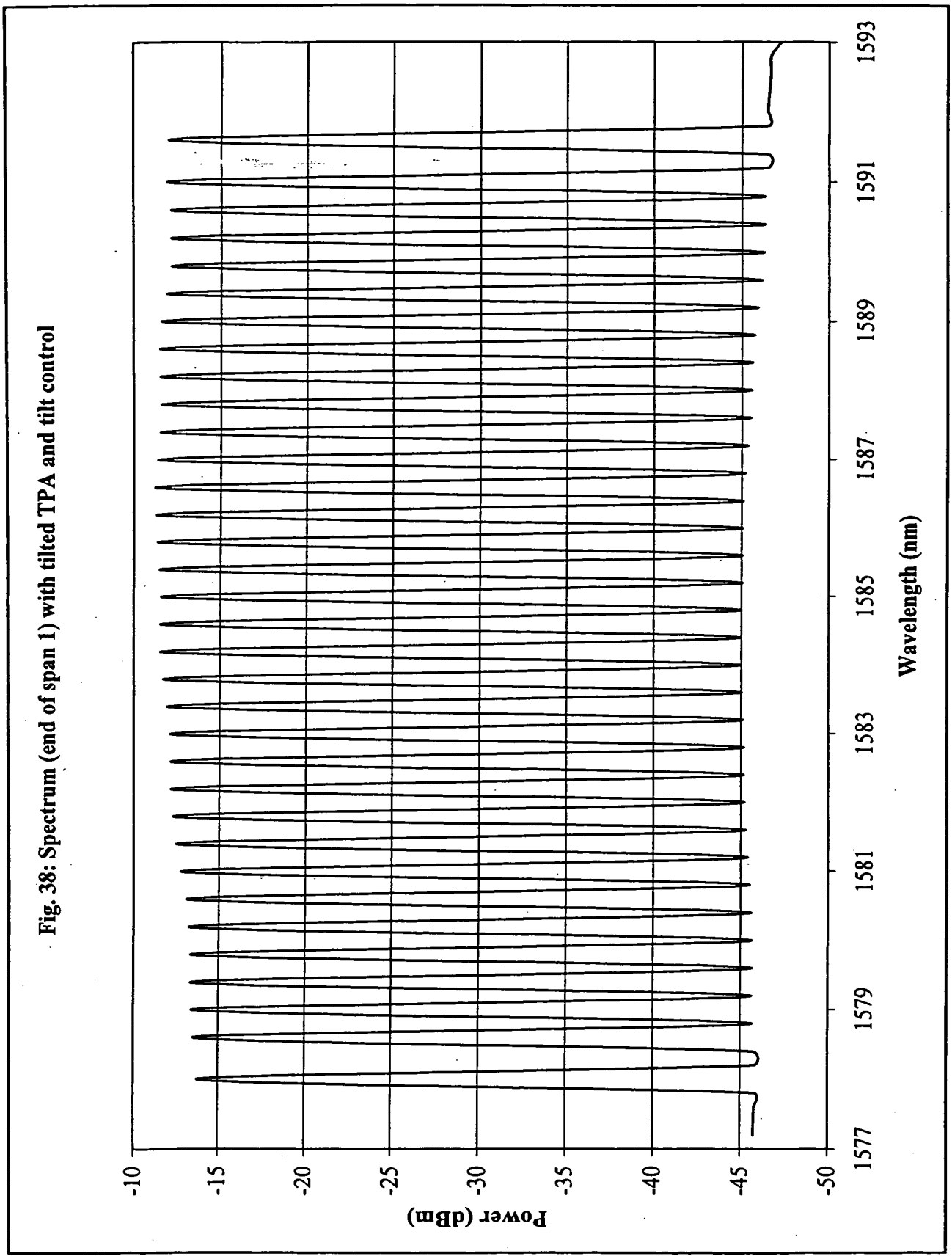


Fig. 38: Spectrum (end of span 1) with tilted TPA and tilt control

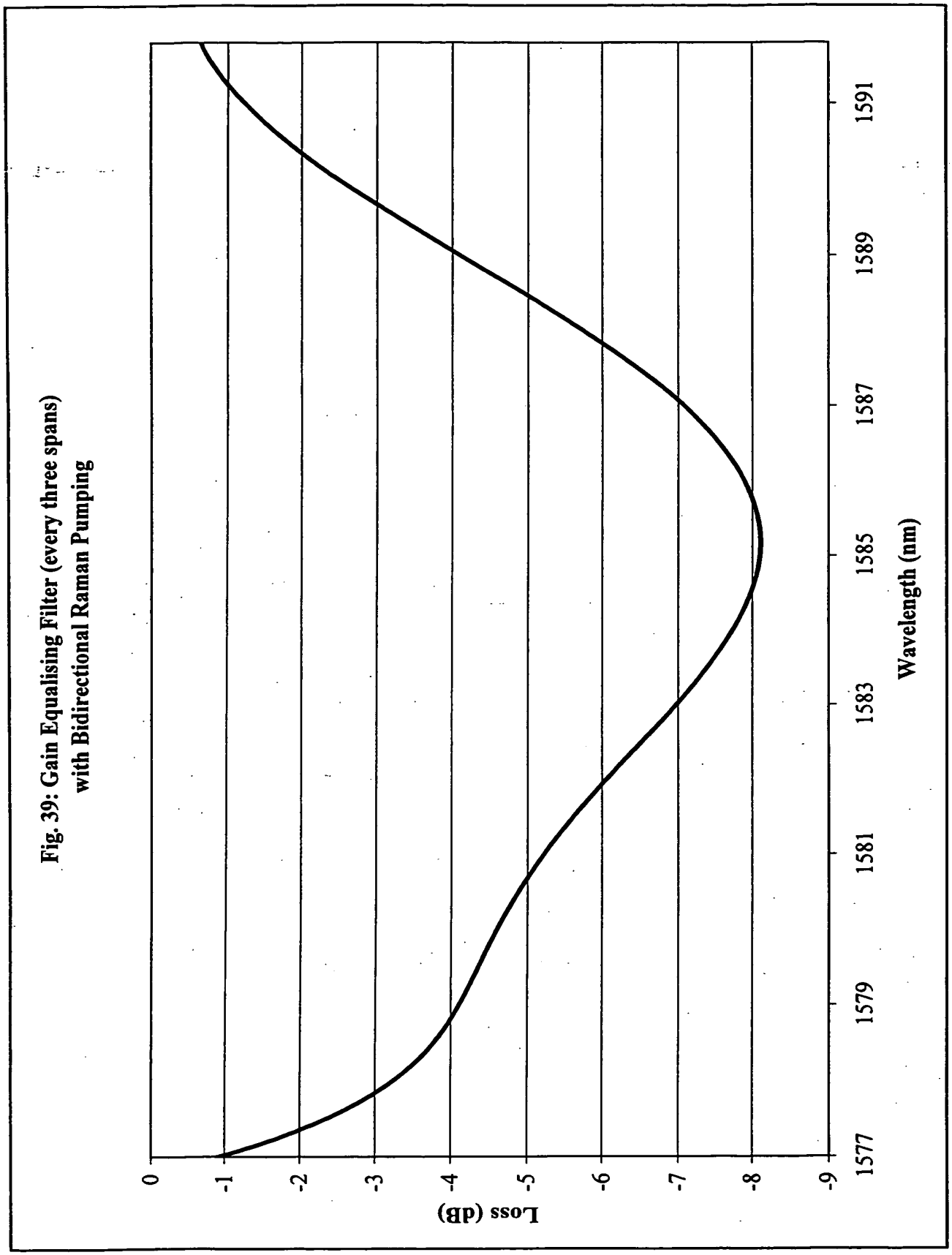


Fig. 39: Gain Equalising Filter (every three spans) with Bidirectional Raman Pumping

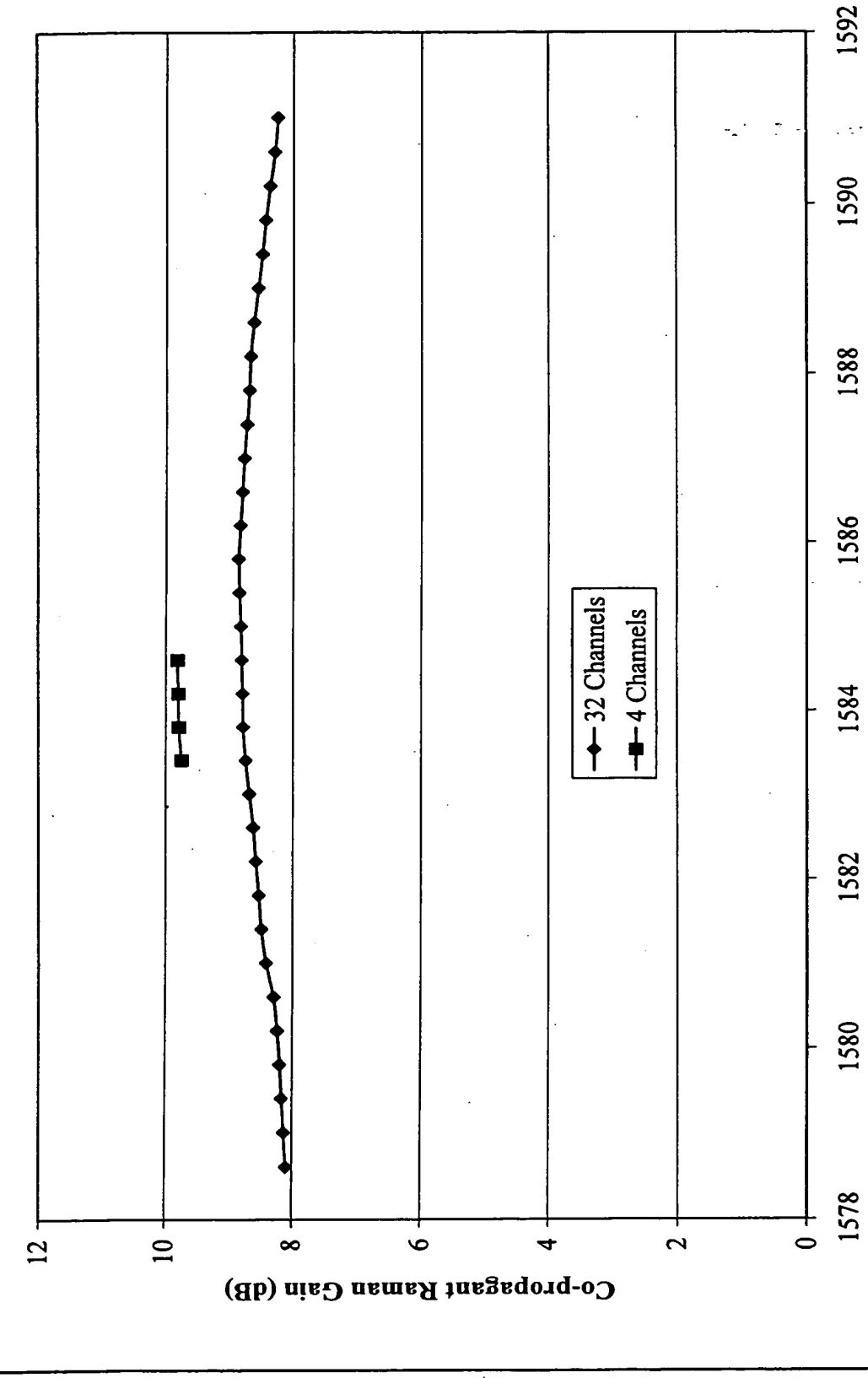


Fig. 40: Co-propagant Raman gain saturation

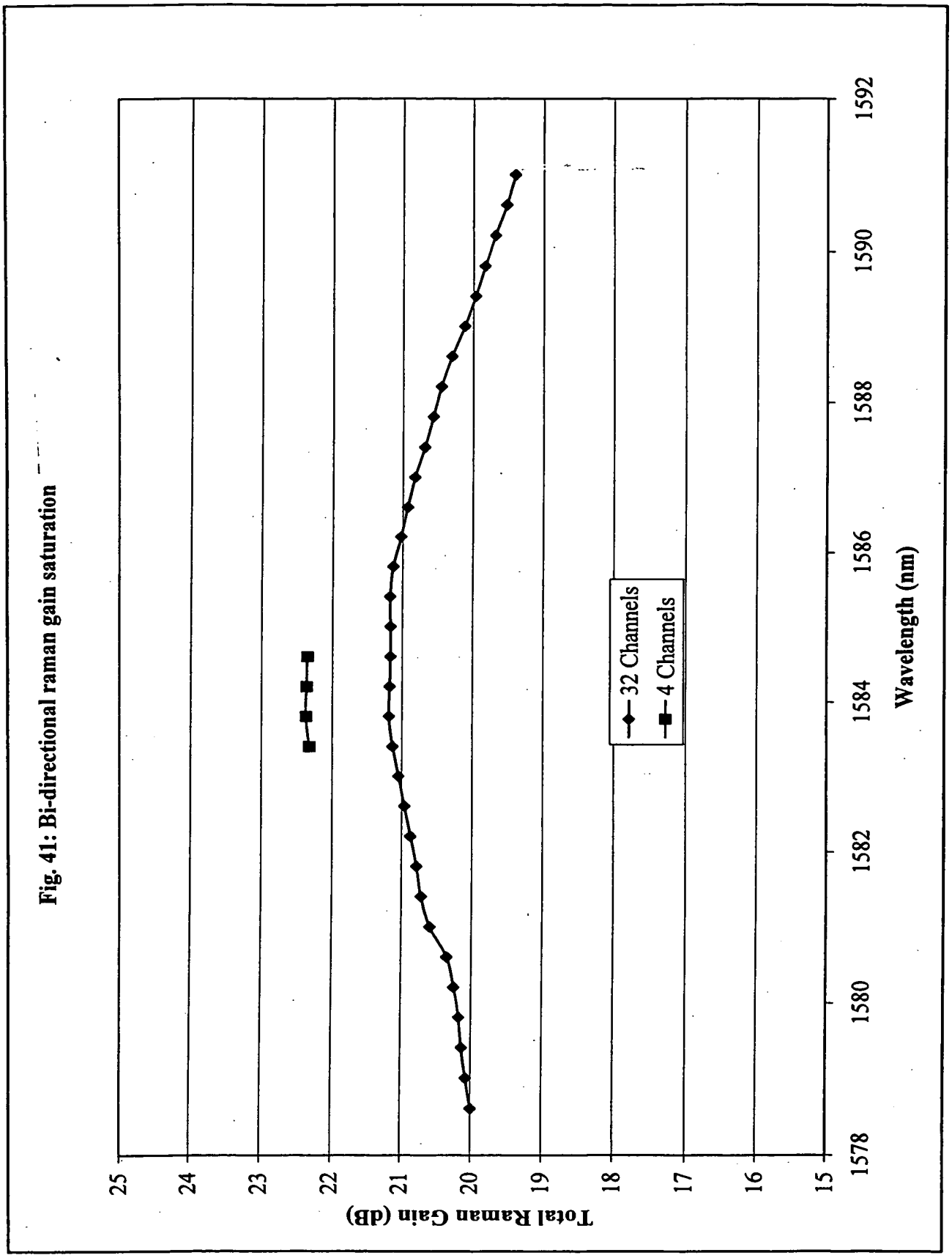


Fig. 41: Bi-directional raman gain saturation

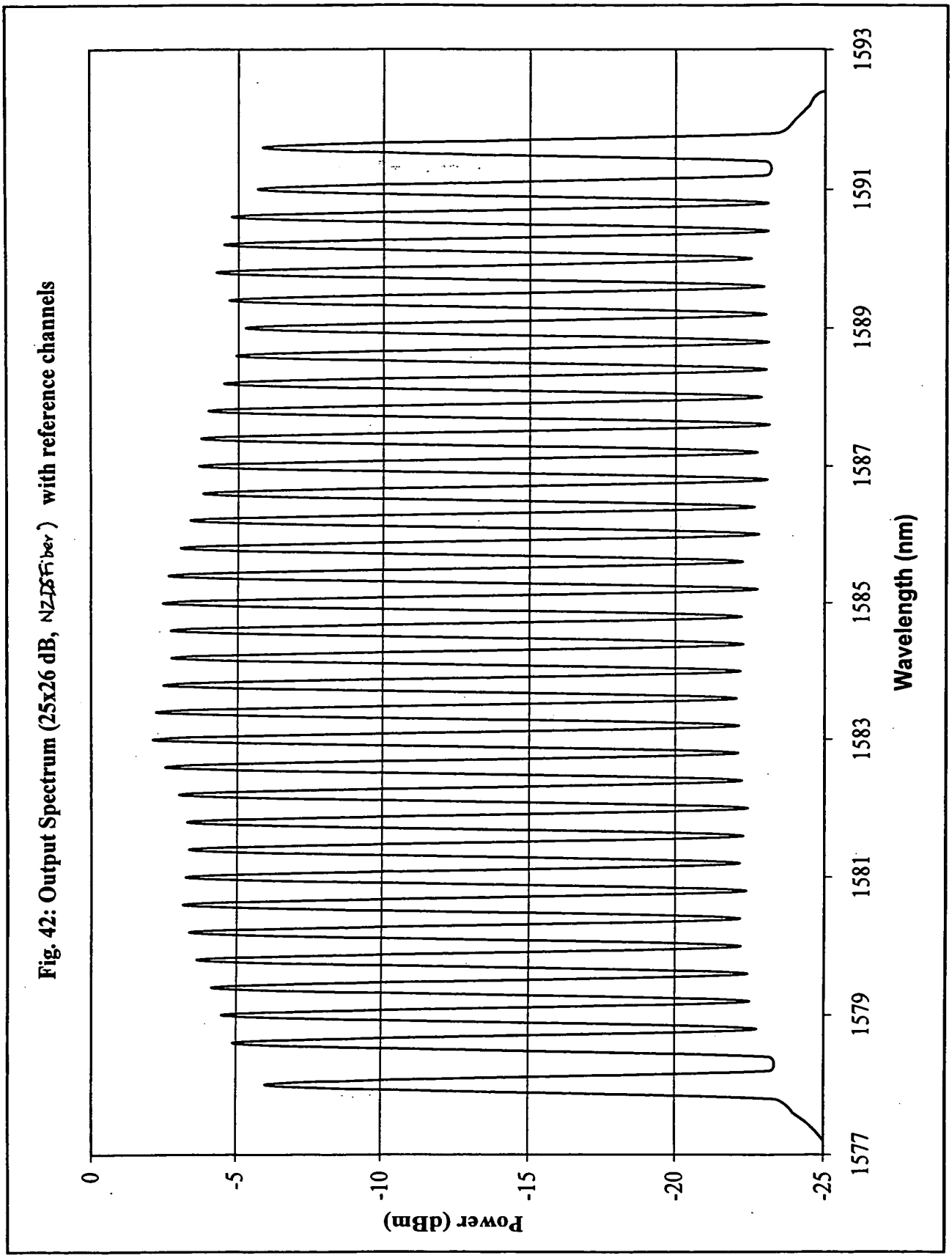


Fig. 42: Output Spectrum (25x26 dB, NZDSFiber) with reference channels

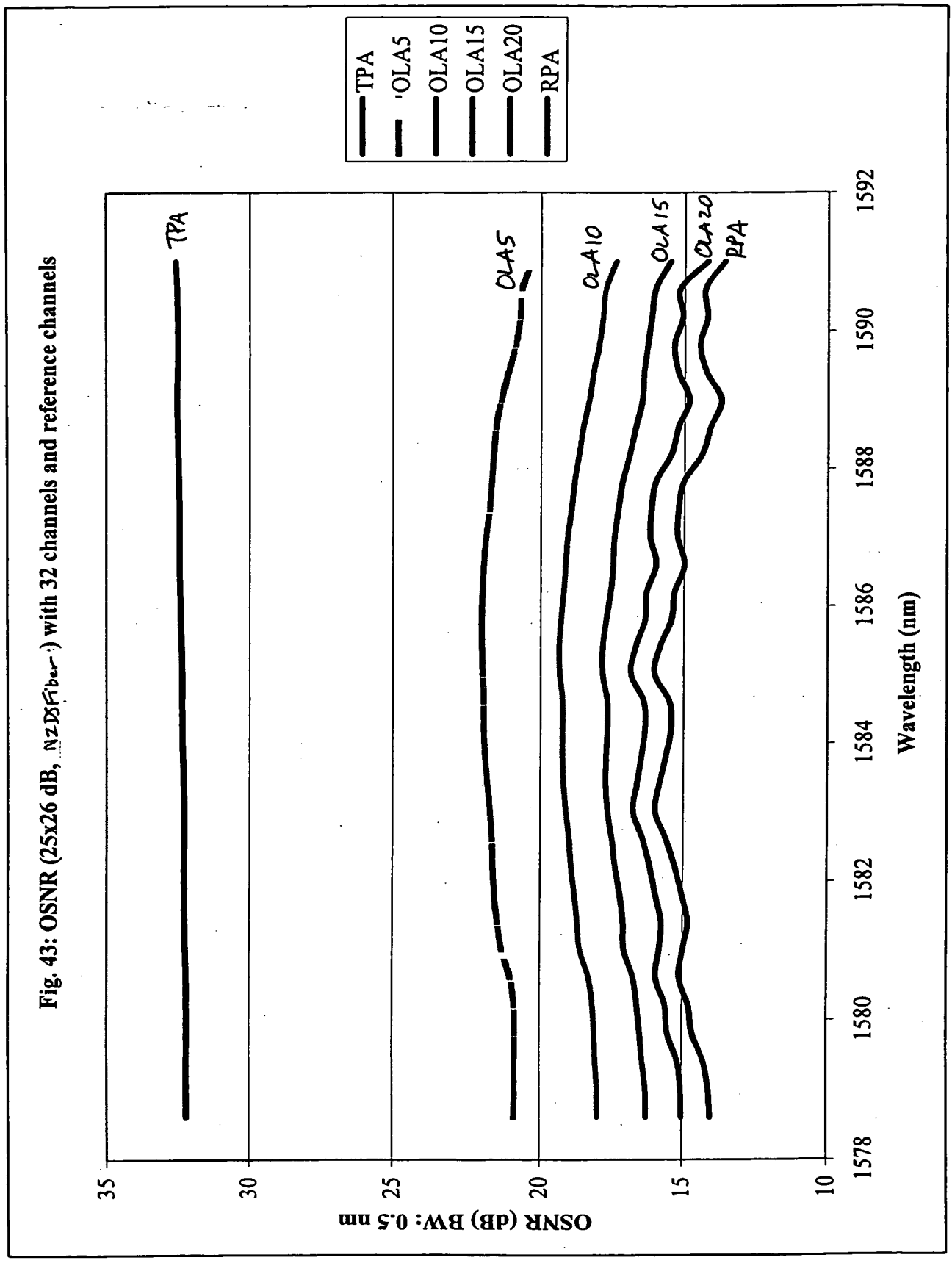


Fig. 43: OSNR (25x26 dB, NZDSFiber) with 32 channels and reference channels

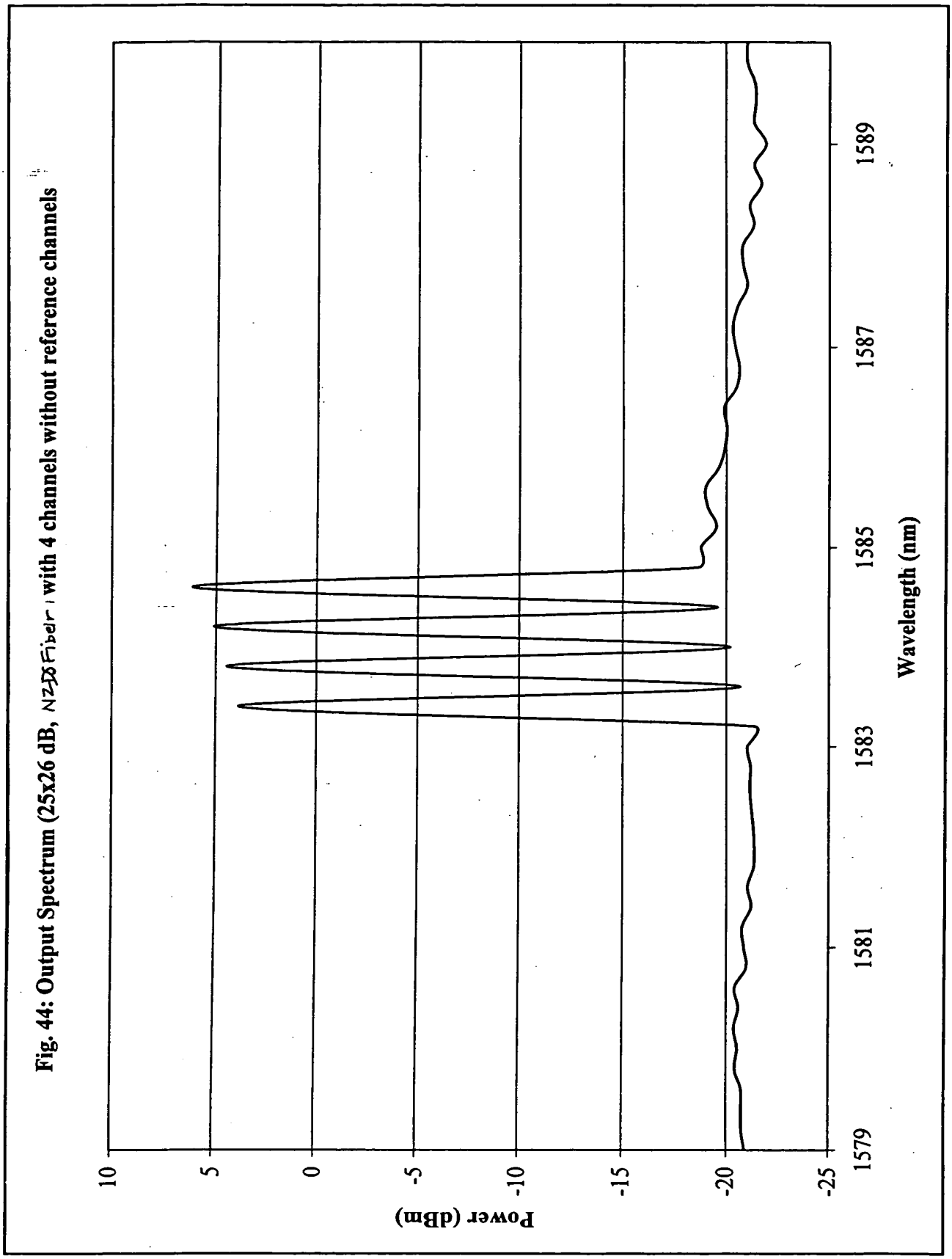


Fig. 44: Output Spectrum (25x26 dB, NZDFiber with 4 channels without reference channels

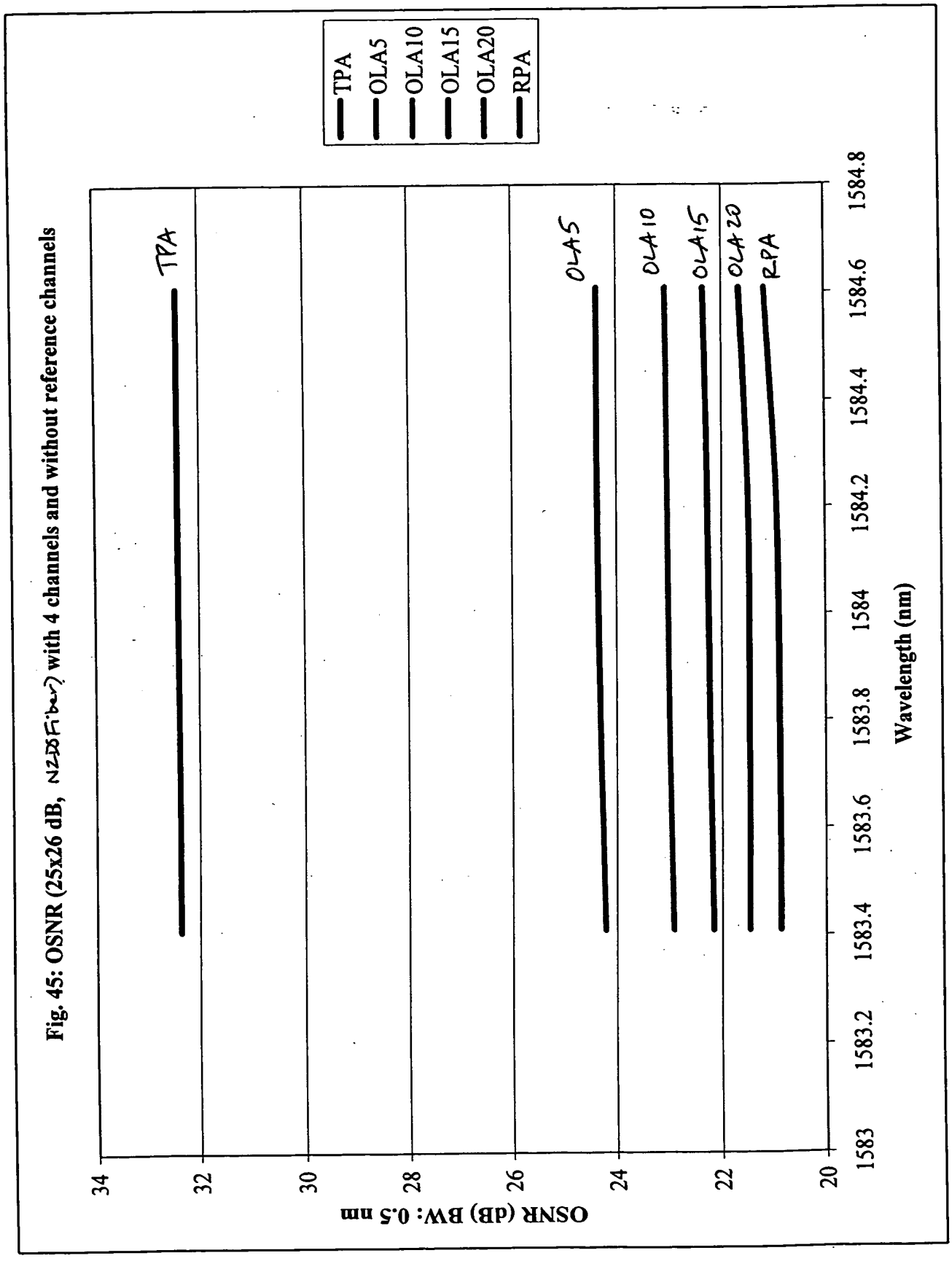


Fig. 45: OSNR (25x26 dB, NZDFiber) with 4 channels and without reference channels

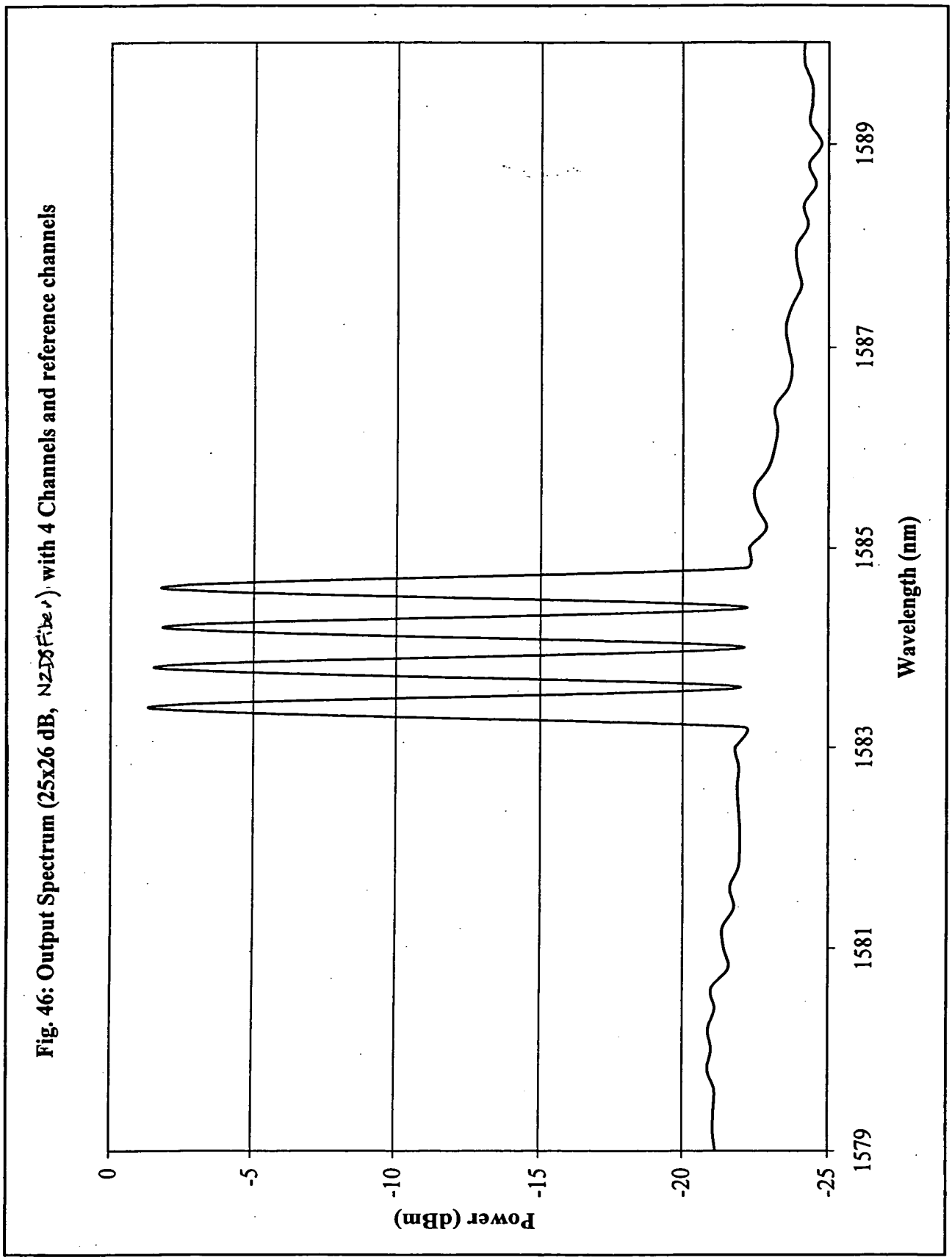


Fig. 46: Output Spectrum (25x26 dB, NZDFiber) with 4 Channels and reference channels

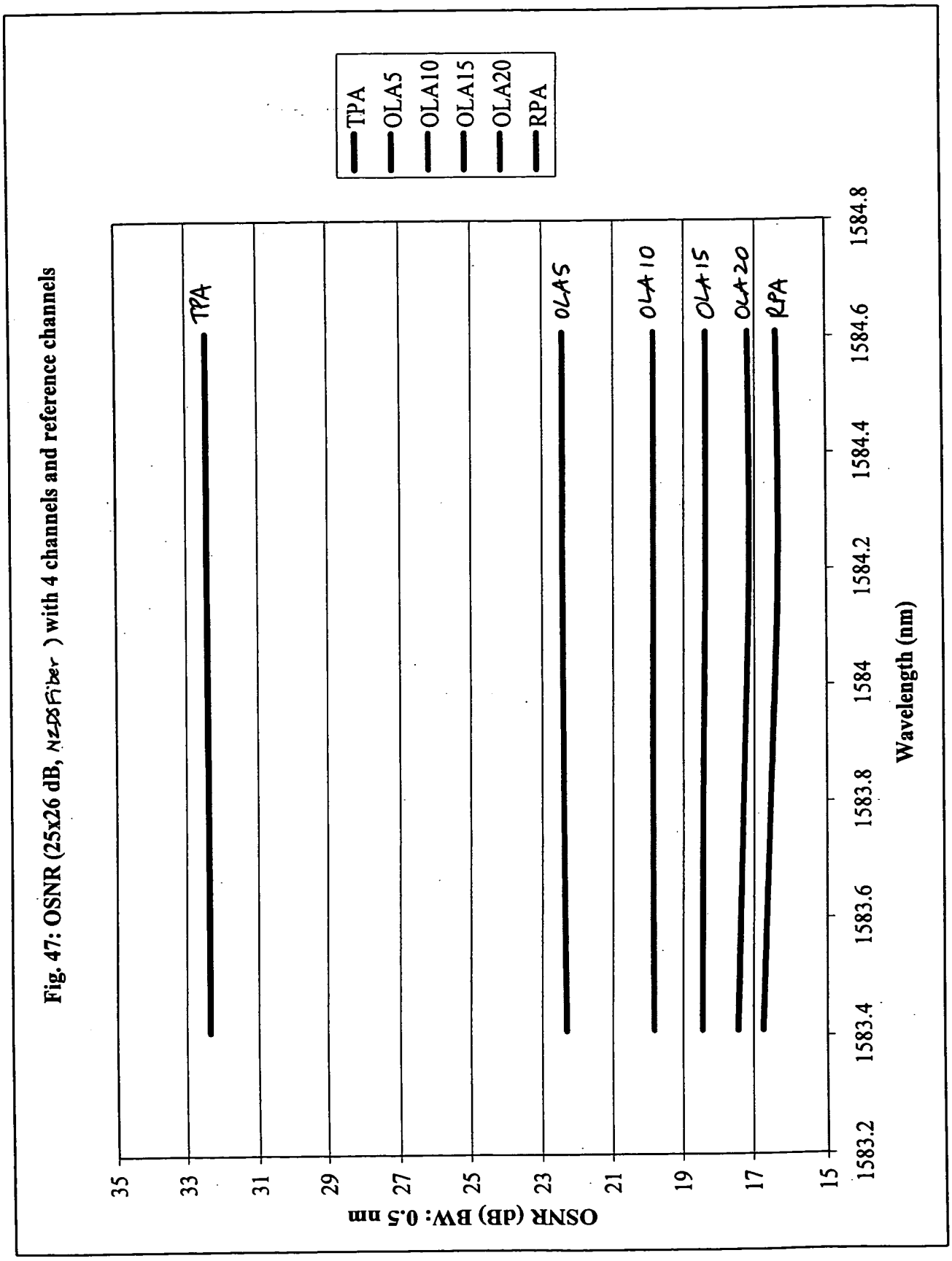


Fig. 47: OSNR (25x26 dB, NZDSFiber) with 4 channels and reference channels

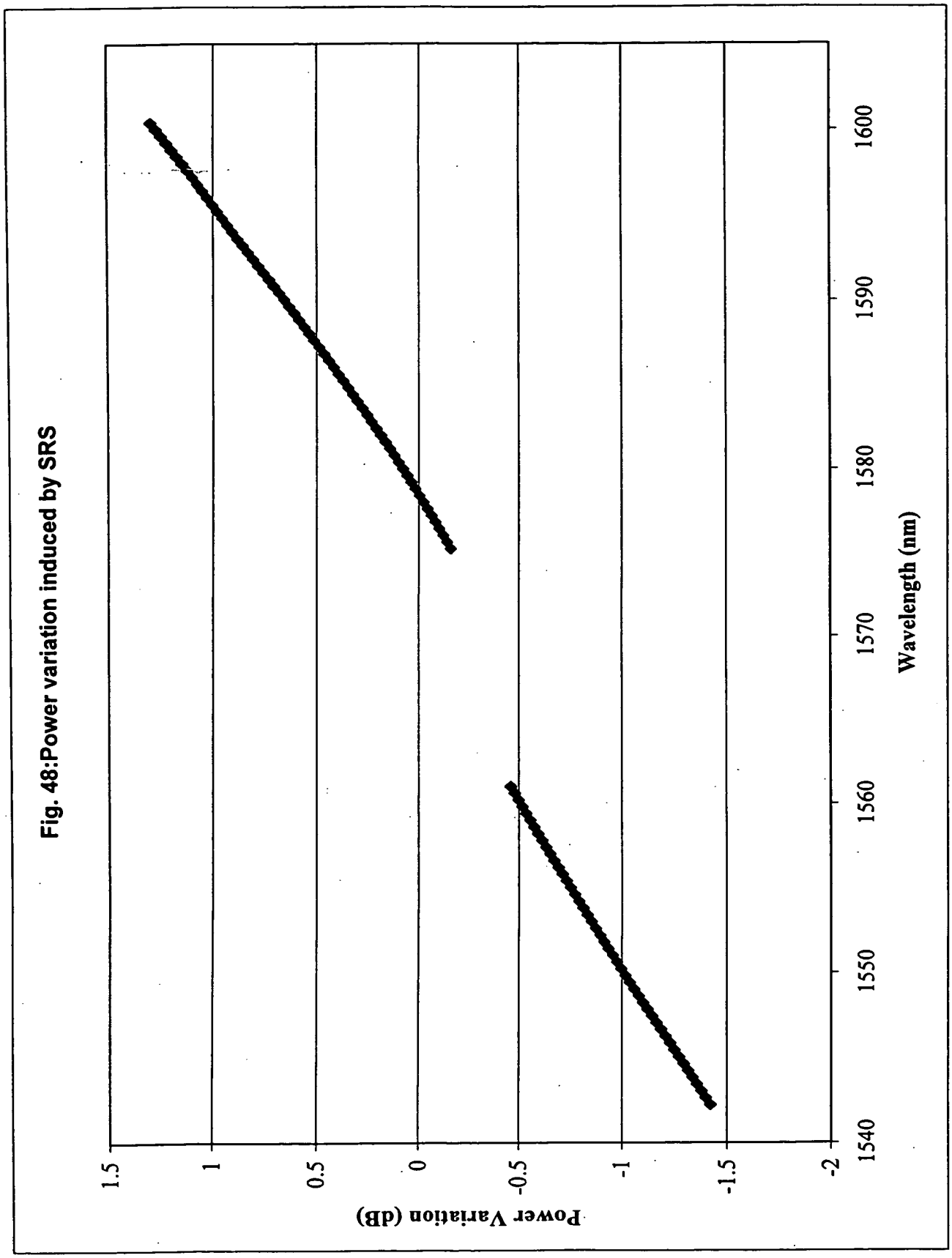


Fig. 48:Power variation induced by SRS

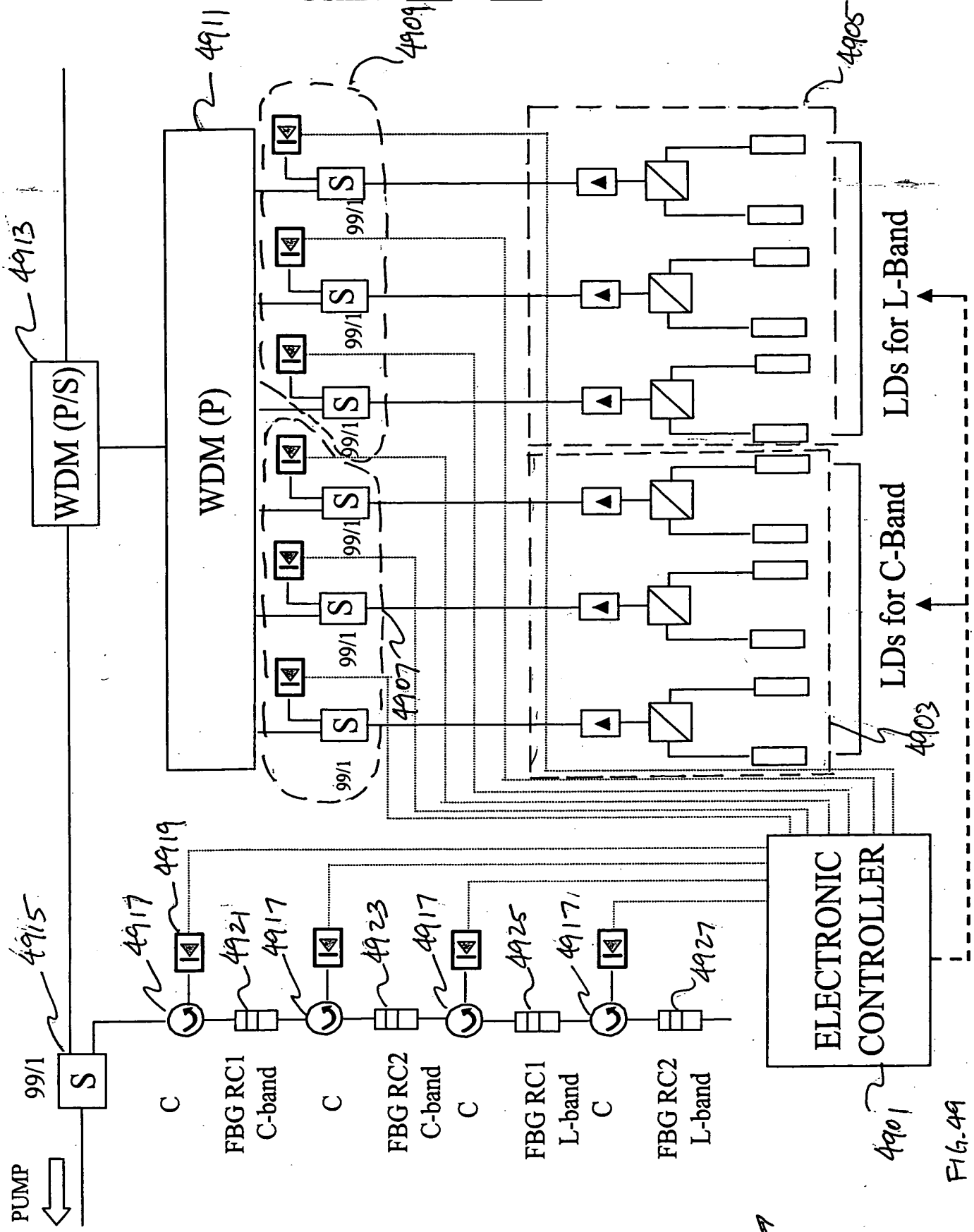

4911
4909
4905
4913
WDM (P/S)
WDM (P)
99/1
LDs for L-Band
LDs for C-Band
4907
4903
4919
4915
4917
4921
4923
4925
4927
ELECTRONIC CONTROLLER
4901
PUMP
C
FBG RC1 C-band
FBG RC2 C-band
FBG RC1 L-band
FBG RC2 L-band
4900

Fig. 49

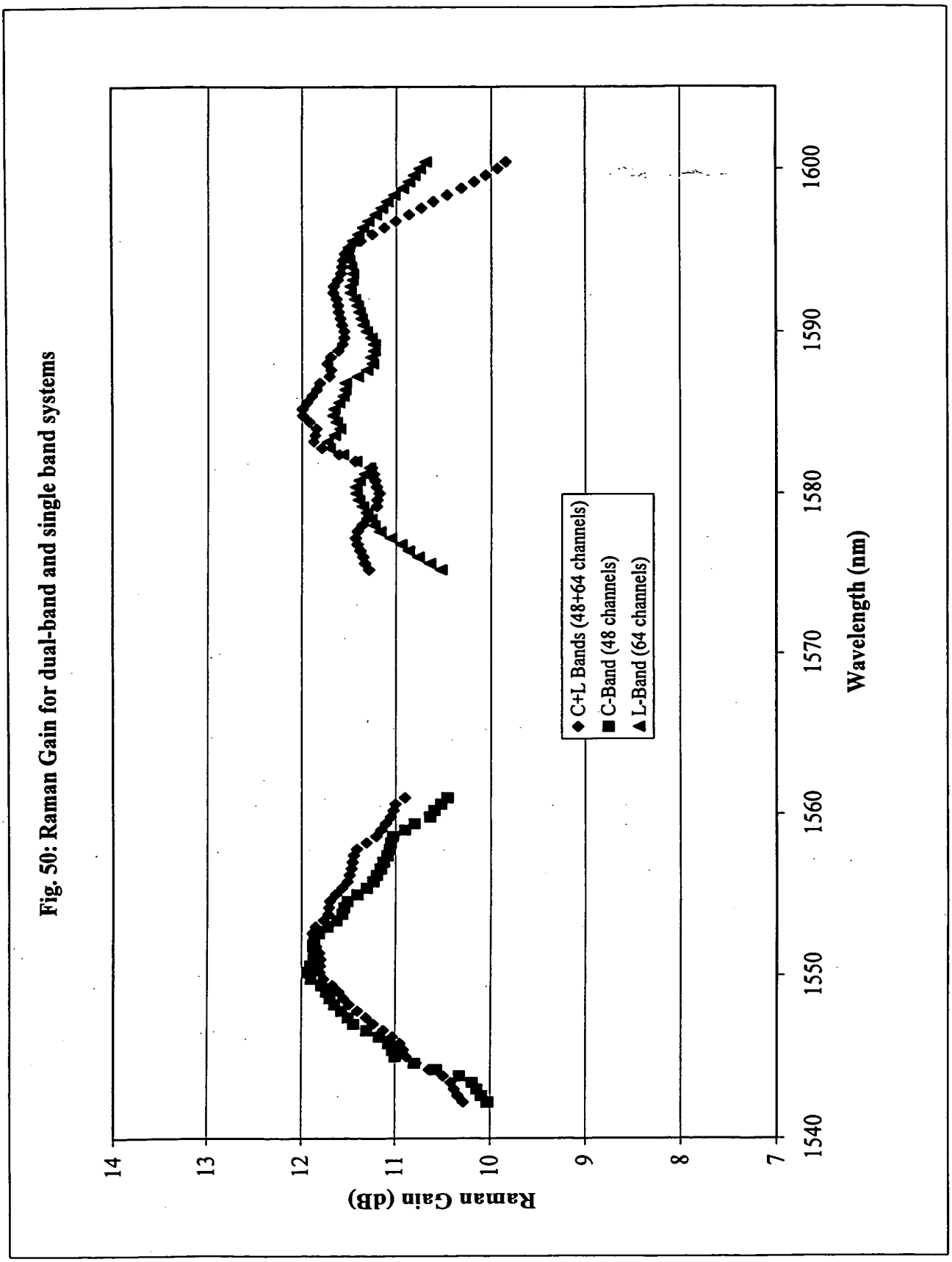


Fig. 50: Raman Gain for dual-band and single band systems

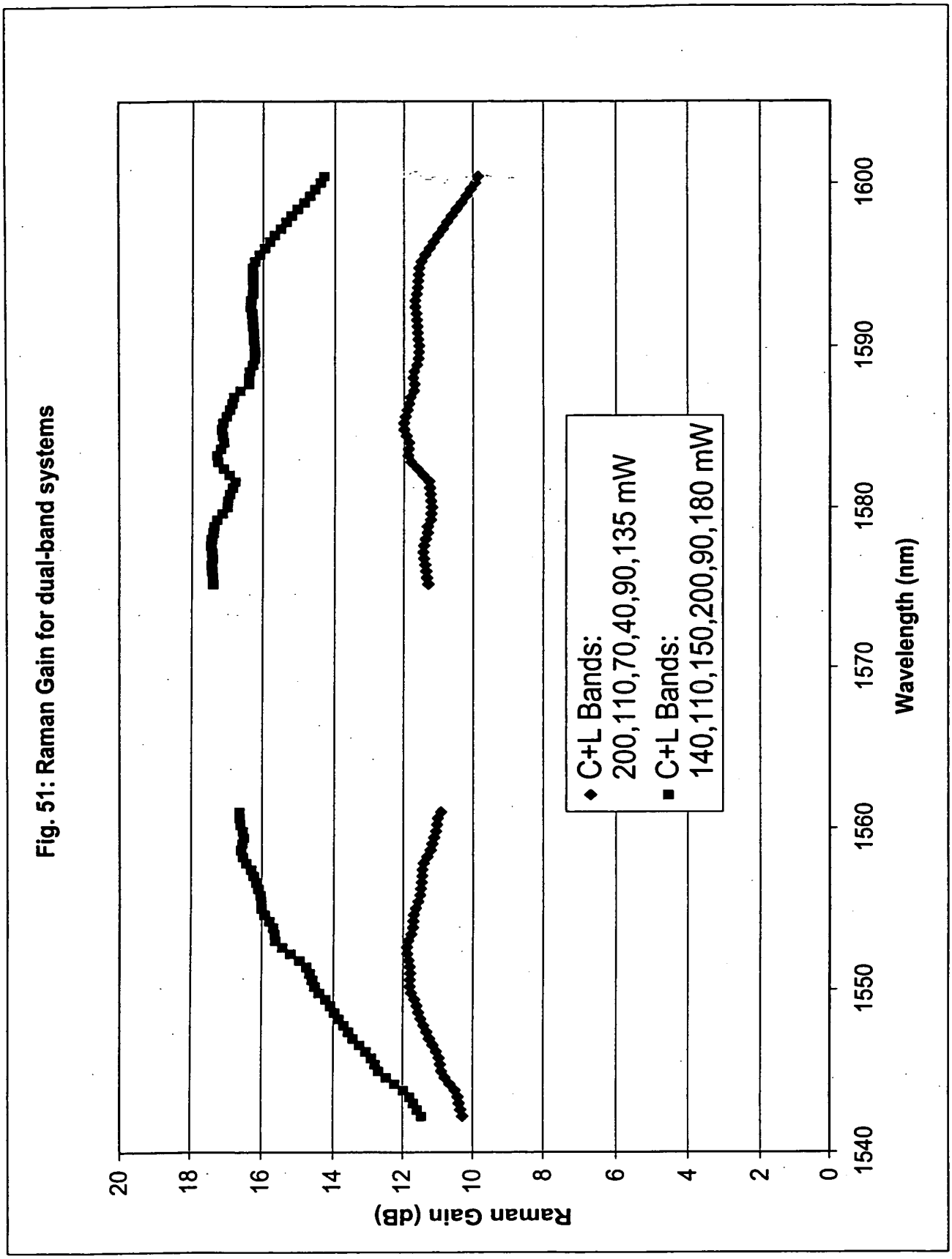


Fig. 51: Raman Gain for dual-band systems